SCIENTIFIC AMERICAN

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THE ADAMS GAS PROCESS.

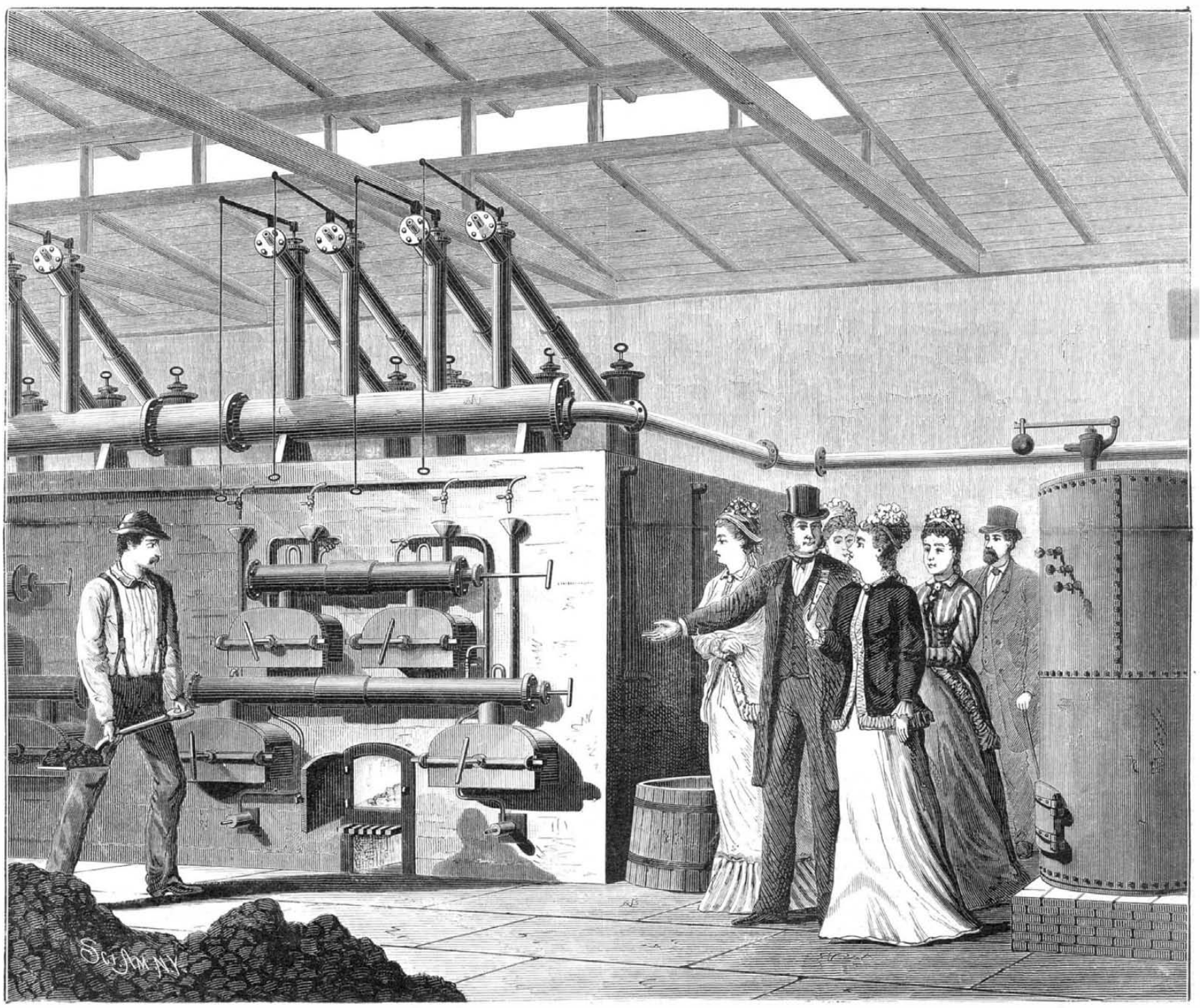
Professor Henry W. Adams, A. M., M. D., of Astoria, N. Y., has recently erected a full bench of retorts, with the necessary apparatus for the manufacture of coal gas by a new process, whereby he claims to have obtained remarkable results in point of economy, rapidity of working, and superiority of product. So far as our inspection has extended, the advantages hereafter detailed seem to be realized; but of this gas engineers and other experts can best judge after consideration of the ingenious system which Professor Adams has devised, and after a visit to the model works which he has erected in Astoria for the purpose of demonstrating the success of his invention. In these works he has a bench containing four full sized clay retorts. These are connected in pairs, each pair being a unit, so to speak, for the purposes of the process, the *rationale* of which is as follows: Retort No. 1 is charged with gas coal in the ordinary way and heated. Two hours afterward retort No. 2 of the pair is also charged, and the products of the fresh charge, tar, aqueous vapor, etc., which are given off before the temperature reaches the point when good illuminating gas is evolved, are led directly into the now highly heated first retort. On the way they are mixed with superheated steam and petroleum vapor. The mingled gases combine with those in retort No. 1 for two hours. Then the charge in that retort is drawn, a fresh charge put in, and the first products of distillation are led into retort No. 2, reversing the former operation. In this way the alternation continues. Professor Adams' trial bench makes, he informs us, 50,000 feet of gas per 24 hours, or over three times the amount which coal alone is capable of producing in the same number of retorts of similar size.

The result of this process is that no tar or ammoniacal water is produced, all the bitumen being converted, or rather decomposed, into gas. Instead of the ordinary average yield of four and a half cubic feet per pound of coal, eight cubic feet of gas, the inventor states, are here produced. As compared with the common process, he furthermore informs us that only one third the number of retorts and one third the labor are needed to make a given quantity of gas in a given time. According to his investigations it also appears that the three gases, namely, from petroleum, from water, and from coal, unite in the retort to form a fixed gas of excellent quality and fine illuminating properties. The general arrangement of Professor Adams' experimental bench is represented in Fig. 1. From the sectional views, Figs. 2 and 3 (page 18), the construction of his apparatus will readily be understood. Referring to Fig. 2, A and B constitute the upper pair and C and D the lower pair of retorts. As the process is the same in each couple, we shall refer, for convenience, chiefly to the upper pair. These in front of the bench are connected by the horizontal pipe, E, in which the mixing of gases is effected. At F are the steam nozzles, which, as shown in Fig. 3, connect by suitable pipes with the superheaters, G, Fig. 3. These are simply clay retorts or pipes placed in the lower flues of the furnace, and into which the saturated steam from a boiler is discharged. It will be seen from Fig. 2 that the products of distillation from retort A, freshly charged, are passing over into retort B, which has been in operation for two hours. The steam jet is seen in operation on the left, and it will also be noticed that the valve, H, which shuts off communication in the pipe, E, between the retorts, is open. In the pipe between the lower retorts it is represented closed. The object of this valve, H, is to shut off connection between the retorts when charging one so as not to lose the gas from the other.

At I, Fig. 3, is the reservoir for oil, which escapes in a fine stream, easily regulated, at the nozzle, J, falling into the retort and upon an inclined apron or gutter, K, Fig. 3. This last is placed in the mouth of each retort, when the latter is charged with coal, for the purpose of causing the liquid to flow back into the hotter portion of the retort, and so conducted to the hottest part of the coal therein.

At L are the four standpipes which are connected to the rear ends of the retorts. The object of this arrangement is to compel the gas tar and aqueous vapors formed in the front ends of the charges to pass through the red hot ends of the retorts and escape from red hot standpipes, being converted into gas during their progress. In order to prevent accumulations of carbon in the mouths of the pipes a tubu-

[*Continued on page* 18.]



GAS WORKS USING THE ADAMS PROCESS.

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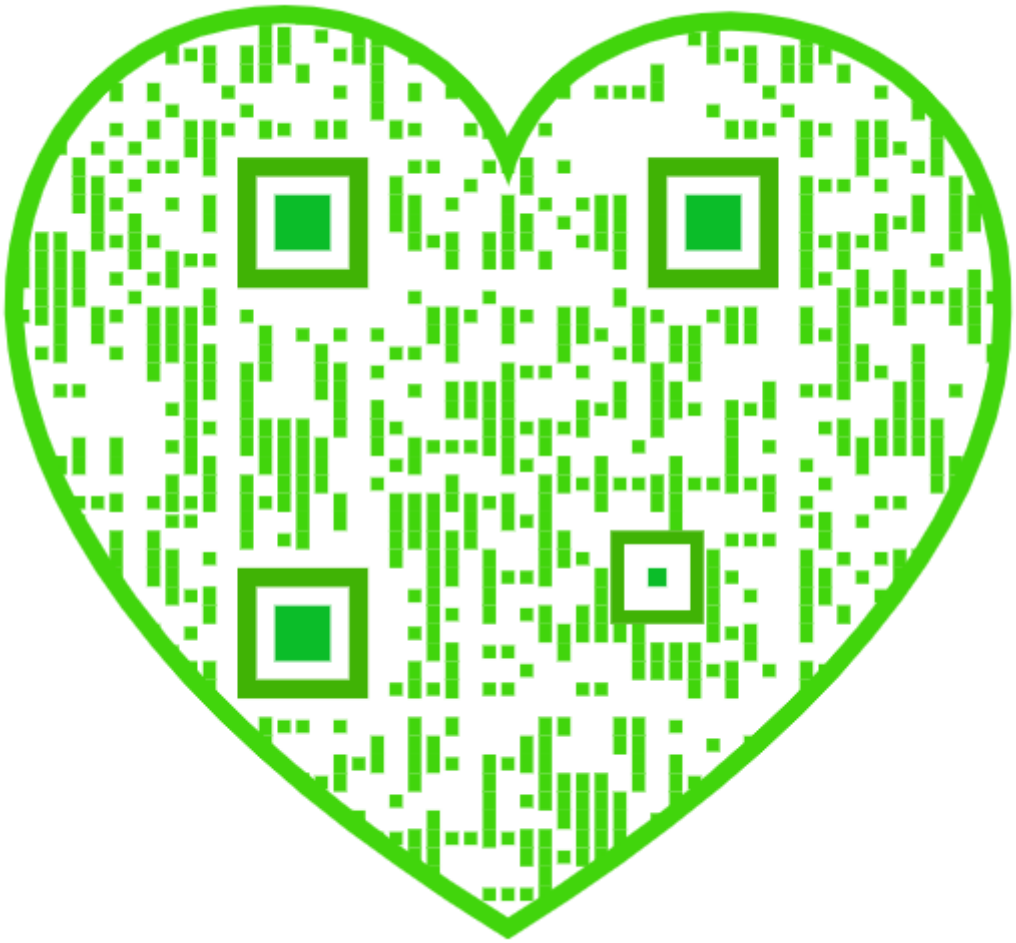

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X. CHESS RECORD.—Biographical Sketch and Portrait of Mr. George Walker, of London.—Grand Problem Tournament of the American Chess and Problem Association of 1878.

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THE INVENTION OF THE MICROPHONE.

In our issue of June 22 last we gave the substance of a communication to us from Mr. Edison, wherein he claimed the origination of the principle of the carbon telephone and the discovery of the variability of the conducting power of many substances under pressure; these facts being those which underlie the construction of the microphone, which is alleged by Professor D. E. Hughes, of London, to be an original invention of his own. Mr. Edison also commented upon an apparent breach of confidence on the part of Mr. W. H. Preece, electrician of the London Post Office Department, to which gentleman Mr. Edison states he communicated the results of his investigations during their progress, including those relating to the adaptation of the new principle to the measurement of minute degrees of heat.

Mr. Preece has cabled a reply, in which he gives "the most absolute and unqualified denial" to Mr. Edison's statements, and further says that "Hughes has not brought out any thermopile. His microphone is quite a different instrument from Edison's telephone." Mr. Preece denies being a coadjutor of Hughes, and adds that he knew nothing of the invention until Hughes communicated it to him. In a postscript Professor Hughes "emphatically indorses" all that Mr. Preece asserts.

It is to be presumed that the very positive expressions of Mr. Preece's answer will be modified by the more detailed defense which he will probably publish, and therefore it is scarcely yet just to express any opinion on the merits of the controversy. It may be pointed out, however, that it is difficult to reconcile the statements that Professor Hughes has brought out no thermopile, with the fact that the *Engineer* for May 17, 1878, published an engraving of such an instrument made by that gentleman from a quill tube filled with metallic powder, and the writer describes experiments which he saw Professor Hughes conduct with it. Mr. Preece also may possess some special knowledge warranting his assertion that the microphone is different from Edison's telephone, but save in a very unimportant modification in form that difference to most people will be imperceptible. The principle underlying the inventions is the same, although it may have been independently discovered by both inventors.

To the personal charges made by Mr. Edison against Mr. Preece, the latter gentleman will doubtless give a more specific reply. He might not, as he says, have been a coadjutor of Professor Hughes, but that he rendered material aid is probable from the fact that Hughes in the first paper read before the Royal Society tenders him his "warmest thanks for his kind counsel and aid in the preparation of this paper."

Since the above was written Mr. Edison has replied to Mr. Preece at length, giving many citations, etc., in support of his statements, the main points, however, being those which we have noted.

PREPARATION OF IRON FUELS.

It is well known that the preparation of coal for smelting purposes by coking is attended with only partial success, so far as the elimination of sulphur and phosphorus is concerned, while at the same time it involves the loss of the hydrocarbons with their high thermal values. Many other methods have been tried, some of which are now in limited practice, having for their ultimate object the purification of the iron to be treated.

Those acquainted with inventors and their fortunes know that many valuable discoveries are long withheld, or not earnestly pressed upon public notice, because the times do not seem propitious or because of the difficulties and disappointments encountered in the attempt, and in not a few instances the patents for these discoveries are permitted to expire unexploited and the invention to become public property.

Of this character is one of which we propose to give a brief description for the advantage especially of those who produce iron from the blast furnace, melt it in the cupola, or work it in the forge, though it is not unlikely that the matter may cover much more extended and other fields.

A suggestion that coal might be desulphurized, and observation of the fact that a handful of common salt thrown into a heated stove liquefied and removed the clinkers, led to a long series of experiments, eighteen or twenty years ago, which resulted in demonstrating that sulphur could not be removed from coal as suggested, but that the coal could be so treated that not only would its impurities be rendered harmless, but that it could also be made to operate as a detergent upon the impurities contained in iron and its ores.

The experiments proved that at certain moderate pressures steam would take up and convey the alkaline salts according to their measures of solubility; that steam thus saturated and conveyed into closed bins or like receptacles containing coal would penetrate to the center of the hardest anthracite as well as of the softest bituminous, the coal becoming expanded by the heat of the steam, and condensing therein would deposit the conveyed chemicals throughout the innumerable interstices; that not more than from six to eight hours of this steaming was required to charge the coal with such fluxes as common salt, potash, lime, etc., in the proper degree and proportions for the purposes intended; and that the operation did not make it more friable or in any way change its appearance.

Thus prepared the coal contained within itself all the necessary elements for neutralizing by chemical action during the process of combustion its own sulphur and phosphorus, as well as for removing these impurities from the ore and iron in contact with it.

Anthracite coal so prepared and used in a blast furnace which was quite foul, first scoured off the clinkers, and afterward, through successive weeks of use, produced an iron, we are told, bearing a tensile strain about twenty per cent higher than any former production of the furnace, while in a cupola furnace it was reported, through many months of trial, as having carried a one third larger charge of iron, and as having run it out in a much hotter and consequently more liquid condition and with an increased tensile strength of about 30 per cent.

Used in many blacksmith forges, bituminous coal so prepared imparted a welding heat more quickly, corrected the cold or red shortness of the iron, and caused perfect welding, while file cutters and tinsmiths successfully substituted it for charcoal in their work. Even the Broad Top coal of Pennsylvania treated by this process and used in locomotives burned with intense heat, without smoke and without forming clinkers on the grates.

It was natural that prominent chemists even should be found to assert not only that a mass of anthracite could not be penetrated by steam, but also that steam could not take up and carry the alkaline salts, and that indifference, opposition, and dishonesty should be encountered at every step, for such is part of the history of every discovery of importance. Nor is it surprising that an inexperienced inventor should withdraw in disgust from such encounters, and, applying himself to other subjects which he might hope would meet with more favorable reception, let the whole matter, as it were, drop out of his life. And yet it is strange that a discovery of such importance as this should have lain unnoticed for so many years, for not only does it enable the manufacturer and worker of iron to greatly improve its quality at a cost of, say, 8 to 10 cents per ton of coal used, but the process may, we doubt not, be applied with great advantage to the treatment of vegetable fiber used in the manufacture of paper, linen, etc.

In our issue of June 29th we spoke of the neglected flax and linen industry of America, and of the general complaint that the American fiber is less skillfully cared for than the foreign and carelessly cured and prepared, and it may be found that in this process there exists a remedy for these conditions, for the same chemicals (and others besides) that are used in the manufacture of paper pulp from straw may be applied to flax, ramie, and the like, and, we should think, without entanglement of the fiber, by suspending the stalks in strong iron tanks and subjecting them to the action of the chemical steam under pressure for a sufficient time for the removal of the silicious and albuminous coating, as well as for the required degree of bleaching, while pure steam might then be introduced for rinsing or cleansing.

Not only in our Southern and Southwestern States is there great necessity for improved machinery and processes for treating vegetable fibers, but the need is not confined to us, as our readers must be aware, for several months since we published the offer made to inventors by the government of India, by which it appears that fifty thousand rupees (about $2,300) are offered to the inventor of the best process or machine which will separate the bark and fiber from the stem, and the fiber from the bark of the ramie.

The best machines hitherto tried for this purpose have failed to meet all the requirements. May not this "chemical steam" process be substituted for or at least satisfactorily supplement them? JACOB I. STOVER.

298 Macon street, Brooklyn.

MILLSTONES.

In the proceedings of the Fifth Annual Convention of the Millers' National Association, held in Indianapolis in May last, there appears a valuable report on mill machinery, prepared by Mr. Joseph F. Gent, of Indiana. Among the practical suggestions given are several relating to millstones. In selecting a stone, Mr. Gent counsels preference for a medium stone in every particular, not too porous or open, and neither extremely hard nor soft. If a close stone is desired, one should be selected that has every block close alike; if an open stone is preferred the same rule should govern, but in no case should a stone be chosen in which the openings or porous parts exceed one tenth of the whole face.

As regards dress, one in which every furrow runs to the eye is preferred for high grinding, and in no case is a dress advisable which makes less than every other furrow a leading furrow. For most kinds of wheat grown in the Northwest, furrows should be $\frac{5}{16}$ inch deep at the eye, and $\frac{1}{16}$ to $\frac{3}{32}$ deep at the skirt. They should be wide enough to insure perfectly cool grinding, and to discharge the chop free and round. With stones grinding on winter wheat, the furrows required are equal to very nearly two thirds of the entire surface of the stone. Draught can only be decided upon when the dress to be put in, the amount of grain to be ground per hour, and the speed and diameter of burrs and quality of stone are considered. Mr. Gent states that with a medium close stone, 4 feet in diameter, at a speed of 130 revolutions per minute, to grind 5½ to 6 bushels per hour, every furrow leading to , 3½ inches would give probably a satisfactory result.

If the old-fashioned stone with small eye is used, the eye blocks should be kept a little below the face of the stone; or in other words, after applying the redstaff, it should touch the whole face of the stone, but show heaviest at the skirt, not in spots, but all the way around. If a stone, while grinding the proper amount of wheat, runs hot and glazes, the trouble is not enough furrow. The stone should therefore be taken up and the furrow widened until the proper amount is ground cool.

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AN HOUR WITH EDISON.

Professor Edison's laboratory, in size and external appearance, resembles a country church. The interior, however, is not so church-like. The first apartment is a reception room, on the right of which is the private office, containing a large library of scientific works. Beyond these there is a large room containing materials and a number of glass cases filled with expensive physical and chemical apparatus. The machine shop at the rear is furnished with the best of machinery and tools, and is kept constantly in operation in carrying out the plans of Mr. Edison. On the second floor there is a single spacious room, which is the laboratory proper. Here, upon the walls, are shelves which are thickly studded with bottles, jars, and boxes, containing all known substances, both common and rare. It is a chronic habit of Mr. Edison to purchase every newly discovered substance, so that it will be at hand should it be required. The Professor states that no substance can be named that is not included in his collection.

In the middle of the floor there is a stand containing a great number of batteries, from which wires run in all directions. Beyond is a table upon which, among other pieces of apparatus, there is a large induction coil, capable of yielding a spark 12 or 14 inches in length. Here also is the carbon relay, the progenitor of all existing carbon telephones, "

on the changeable conductivity of carbon under a varying pressure.

No one can pass by the phonograph, and the Professor himself does not tire in experimenting with this wonderful machine.

One phonographically cultivated can no longer be satisfied with "Mary had a little lamb" and selections from Mother Goose, for now the phonograph can sing, and not only a simple melody, but a duet, and even furnish you with an accompaniment and applause at the same time.

The phonograph which Mr. Edison uses in his laboratory has a double mouth-piece, and the machine will faithfully reproduce a duet sung in it; but the most interesting performance is to hear the Professor sing a duet alone. Singing first the air of "John Brown's body," etc., and afterward the bass over the same matrix while listening to the air as reproduced by the instrument, he produces a matrix which will sing both treble and bass. Not satisfied with this, he whistles Yankee Doodle, and finally, over the same matrix, talks in a loud voice, so that when the whole is reproduced we have a first-class street corner bawl, which is like this: Two fellows singing John Brown, another whistling Yankee Doodle, and a perturbed citizen crying from an upper window, "O shut up! Go away! If you can't sing better than that the police will arrest you! Police! police!"

In the extreme rear end of the laboratory, among a host of funnels, jars, acoustic and pneumatic apparatus, there are telephone wires, with which are connected a carbon transmitting telephone and a receiving instrument. Standing some 8 or 10 feet from the transmitter, Mr. Edison said, in an ordinary tone of voice, "

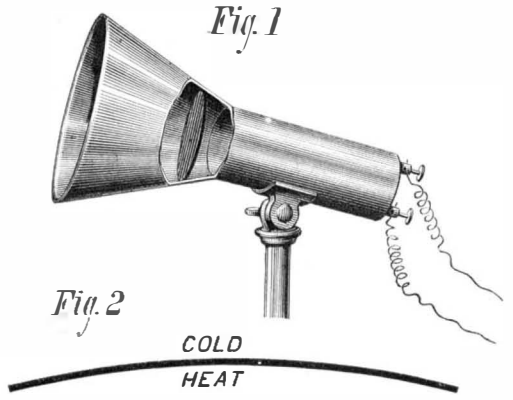
the other end of the line. "I do." Q. "What do you pay for it?" A. "Three dollars and twenty cents a year." Q. "What is your opinion of it?" A. "It is the best of its kind." Q. (while crumpling a paper) "What am I doing now?" A. "Crumpling a paper." Then followed music from a music box of the smallest size, and other tests, showing the wonderful perfection and power of the instrument.

The thermo-telephone, explained by the Professor, although at present without special practical value, is certainly a novelty. It consists of a thermopile having placed in its collecting funnel a hard rubber disk, as shown in the first engraving. A sound made in front of this disk is heard in a receiving telephone connected with the thermopile.

The *rationale* of this is at once apparent when a strip of hard rubber is placed against the lips and bent, as shown in the second engraving, so that the strip will be alternately concave and convex. The difference in temperature is very perceptible, the convex surface being cold and the concave surface warm, and, however rapid the vibrations which render the surfaces alternately convex and concave, the result is the same.

We witnessed an experiment illustrative of the principle of Mr. Edison's electro-motograph, a telegraphic instrument in which the sounder is operated without magnets. In this experiment, which is illustrated in Fig. 3, a strip of chemically prepared paper is laid upon a metallic surface, which is connected with one of the battery wires, and a platinum faced spring which is attached to the other battery wire is taken in the hand and pressed firmly on the paper strip; at the same time force is applied in the direction of the length of the strip. A telegraph key is placed in the electric circuit, and when the current passes through the paper the salt contained by it is instantly decomposed, so that it acts as a lubricant, permitting the spring to slide easily on the paper while the current passes, but immediately the current is broken the friction is sufficient to stop the spring.

Fig. 1

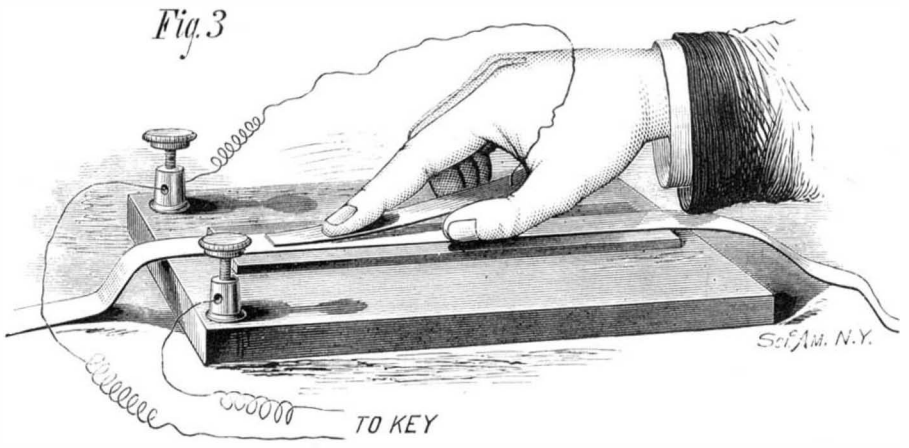


THERMO-TELEPHONE.

The best solution for saturating the paper is made by dissolving 1 lb. of sulph. soda in 1 gallon of water. Any of the sodium salts will answer.

Electricity as a motive power, until now, has been a comparative failure, as 90 per cent of the battery has been wasted. Professor Edison has devised a novel electrical machine which he calls the Harmonic Engine, in which 90 per cent of the power is realized. With two small electro-magnets and three or four small battery cells, sufficient power is generated to drive a sewing machine or pump water for household purposes.

Fig. 3

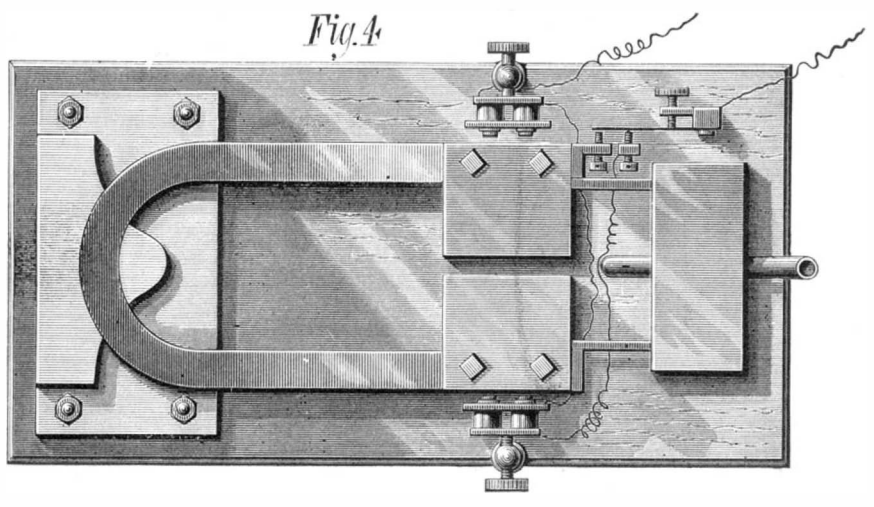


ELECTRO-MOTOGRAPH.

This engine, which is represented in Fig. 4, consists of a fork 2½ feet long, made of 2 inch square steel. The curved part of the fork is firmly keyed in a solid casting which is bolted to a suitable foundation, and to each arm of the fork is secured a 35 lb. weight. Outside of and near the end of each arm is placed a very small electro-magnet. These magnets are connected with each other, and with a commutator that is operated by one of the arms.

The arms make 35 vibrations per second, the amplitude of which is ⅛ inch. Small arms extend from the fork arms into a box containing a miniature pump having two pistons, one piston being attached to each arm. Each stroke of the pump raises a very small quantity of water, but this is compensated for by the rapidity of the strokes. Mr. Edison proposes to compress air with the harmonic engine, and use it as a motive agent for propelling sewing machines and other light machinery. The power must be taken from the fork arms so as not to affect the synchronism of their vibrations, otherwise the engine will not operate.

Fig. 4



EDISON'S HARMONIC ENGINE.

Suspension Bridge Accident.

A serious accident, resulting in the death of two men, recently occurred on the New York anchorage of the East River Bridge, through the breaking of one of the parts of the wire rope which formed the tackle by which a strand of the cable was being lowered into place between the eye bars. The rope measured 1¼ inch in diameter, and to all appearances was perfectly sound. The strain upon it, some 75 tons, was below that which the tackle should withstand, and it is supposed that jamming against the edge of the sheave, or some other indefinitely known accidental cause, determined its rupture. The strand fortunately swung over the previously finished part of the cable, and thus was prevented from damaging the buildings below as it flew through the air between anchorage and pier. The part crossing the river at once sagged down to the bottom. The strand has since been cut and taken down, and a new one is being made. The two men killed were struck by the flying ropes, one being killed instantly and the other mortally injured by being thrown from the anchorage to the ground. The accident will delay progress on the bridge for a few weeks.

microphones," and other instruments dependent

Mill Explosion Science.

Mr. J. D. Hayes, of Detroit, Mich., took occasion at the recent Convention of the National Millers' Association to remark in opposition to the view that mill dust is explosive as follows: "We know that machinery running with a belt or wire is likely to produce a certain amount of electricity, and the dust may become charged with electricity. You may take gunpowder into the street packed in a box and it would be explosive, and so would also nitro-glycerine. But nobody ever heard of a case of blasting a rock with mill dust." (Applause.)

While we would not for a moment seek to impair Mr. Hayes' own good opinions of his bad ones, we would state, for the benefit of those who may accept what is said at the Convention and hence widely published as authoritative, that mill dust owes its explosiveness to its finely comminuted state and free admixture with air, in which condition its oxidation occurs with great rapidity. Mr. Hayes' supposition seems to be that some one has asserted that mill dust is inherently explosive under all circumstances, because of an unstable chemical nature, as in the case of gunpowder or nitro-glycerine. The simple experiment of trying to explode a barrel of flour with a percussion cap will demonstrate to him how untrue this must be; but, on the other hand, when Mr. Hayes lights a stove next winter, he may remark that the little sticks of wood burn quicker than the big ones, and the smaller they are the faster they burn. And if he will carry the process of comminution of the sticks downward by the aid of a penknife he will discover still more rapid combustion, until probably he may mentally discern the fact that when two hundred sticks (which exactly answer to constitute mill dust) become infinitesimally minute they may burn so quickly in the air as to produce an explosion.

Learn Something.

A young man stepped into the office of the Indianapolis Rolling Mill not long since and asked for work. "What can you do?" asked the president. "I don't know," said the young man. "Have you a trade?" "No, sir." "Where did you come from?" "From Pennsylvania." "Are you a German?" "No, sir; I am an American." "If you were a German, or an Irishman, or a Frenchman, I could set you to work, because you would know how to do something, but Americans don't know anything about practical business."

This reply may not apply to all Americans, but it is lamentably true to a great extent. In Germany the boy is brought up where he sees something done, and has some idea of doing it. Very few Irishmen or Germans but know how to turn over a few rods of ground and raise something upon it. Most of them have some idea of mechanical operations, the production and uses of material and of tools.

It is those born in America who are ignorant and idle. It is the false notion that a man does not need to labor, or that he can get his living by his wits, that causes a large part of our idleness and distress. Begin at once to learn something; no matter your age, learn some practical pursuit at once.

EXPERIMENTS recently made with an electric light in this city showed that by its aid ordinary print could be read at night half a mile away.

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THE ADAMS GAS PROCESS.

[*Continued from first page.*]

lar cutter shown at M is employed. At N are the saddle pipes, provided with steam pipes, O, for conducting steam through them to cleanse them.

In order to remove the fine particles of carbon which the gas contains, it is caused to bubble through the liquid which seals the dip pipes, P, in the hydraulic main. To this end a ring of holes is made near the end of the dip pipe, and the main is filled with water and gelatin or other gummy substance until the fluid level is above the holes. The gas forces down through this liquid and escapes in jets from the orifices. By means of buckets arranged under the ends of the pipes, as shown at Q, Fig. 3, the holes may be closed. and the gas generated in one retort may be turned into another.

Professor Adams has provided exceedingly ingenious arrangements for washing his gas which we have not space to describe, but which may be seen in operation at the model works above referred to. It will be observed that a large number of new and different devices are here embodied, so that the entire process is novel and interesting apart from its economical advantages.

The invention has been patented through the Scientific American Patent Agency in the United States and all the principal foreign countries. For further information address the inventor as above. He invites all gas companies and gas engineers to visit his works, and see a full demonstration of the rapidity and economy of his system of gas making, by which he unites the gases from coal, petroleum, and water into a fixed gas of dazzling whiteness and brilliancy.

Fig. 2

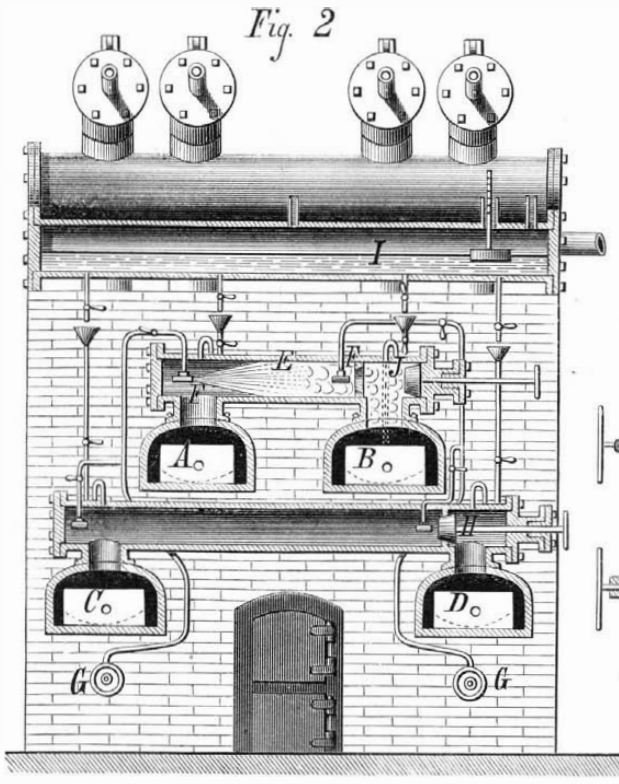
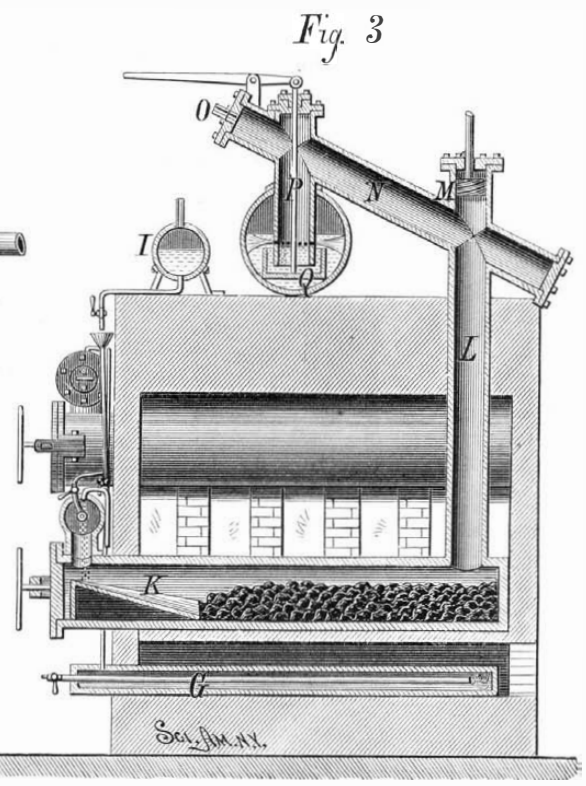


Fig. 3



SECTIONAL VIEWS OF ADAMS' GAS RETORTS.

UNSINKABLE STEAM VESSELS.

We take from the London *Graphic* the annexed engraving of a new steel vessel devised by Mr. Edmund Thompson, and claimed to be "unsinkable." This he proposes to accomplish by constructing a cellular frame of thin flanged steel plates, so arranged as to form a series of cells not exceeding 6 feet in dimensions, forming, in fact, a "honeycomb" side, which, when plated over on the inner and outer face, and properly strengthened by longitudinal ties or braces, will afford the greatest strength, with the least possible weight of material, and, in addition, from the inclosed air spaces surrounding the vessel's hull, will give such an enormous lifting power that armor plate of greatly increased thickness may be safely carried, if placed, as proposed by the inventor, within the inner frame, and not, as at present, external to the vessel's side. The advantage of this plan is equally applicable to merchant vessels, as the cargo will be kept free of the sides of the vessel, whereby the tendency to roll or capsize will in both cases be reduced to a minimum. The trunking up of the hatchways, and carrying the transverse bulkheads up to the upper deck, are also proposed, and therefore the effect of an accident either from fire or water would be localized to the compartment affected.

Mr. Thompson's plans of building are applicable either to double or to single ships, or to a modification proposed by him of having a single forward hull, but the after-end tunneled so as to form a double body, between which the screw could be placed about one fourth the ship's length from the stern, completely securing it from injury from shot or wreckage, as well as obviating "slip" and "racing" of the propeller.

Our illustration shows a raft, supported on two pontoons, built on the "cellular" principle, carrying a heavy battery (three feet in thickness where requisite) and an armament, consisting of one 100 ton gun and two 38 ton guns, propelled by two or four screws working between the pontoons, which will only draw six feet of water, the dimensions of the vessel being 400 feet in length by 80 feet in breadth. By reversing either the forward or after screws, the vessel would turn on her own "center," affording that special desideratum, an "all round fire."

The other vessel shown in our illustration is a torpedo boat, with cellular sides, and the screw placed in a tunnel, as before described. This boat would be fitted with noiseless engines, and, by filling the air tubes of the cellular sides with water, could be submerged almost to the water line, to enable her to approach an enemy with slight risk of detection.

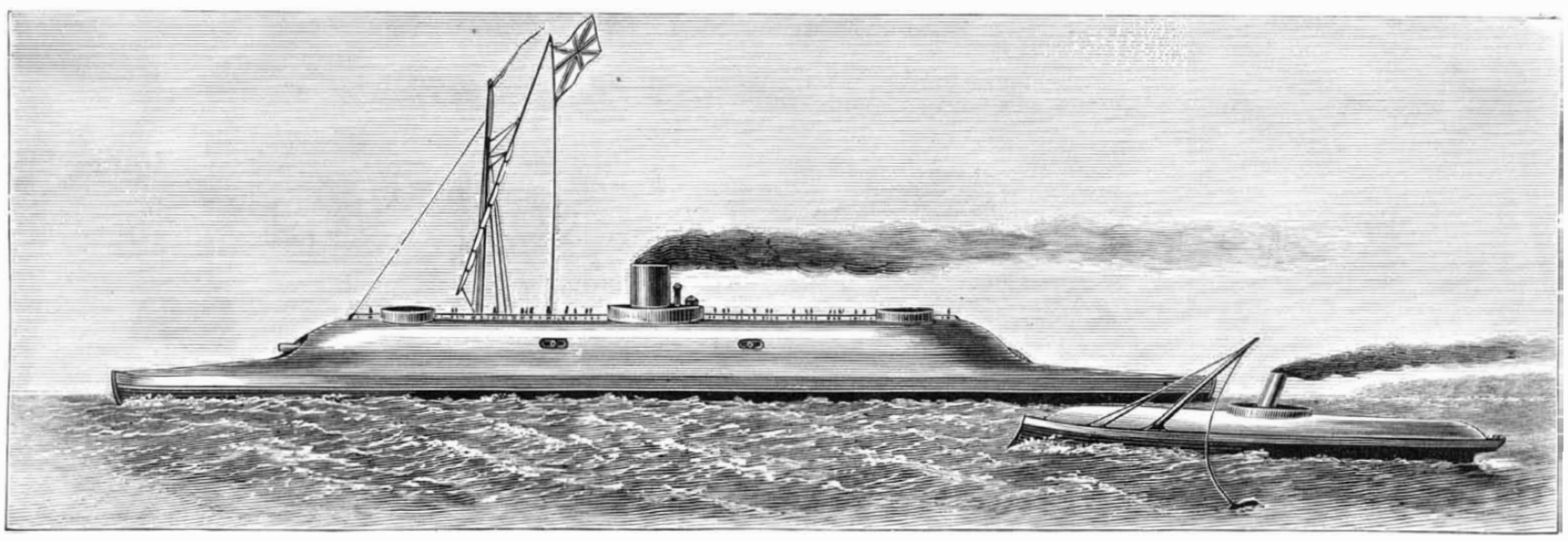
Our Naval Tubs.

The *Army and Navy Journal* says: "Of our Asiatic fleet, a correspondent writes as follows: 'Reports from our ships in Japan and Chinese waters are not encouraging. The Tennessee left for home in March. Under favorable circumstances she can steam eight knots an hour, but her consumption of coal to maintain that speed is as great, if not greater, than the ordinary simple engines would require. The Ranger, one of the additions to the navy under the Eight Sloop Bill, is a failure so far as the compound engines are concerned. She can steam, under favorable circumstances, seven knots per hour, and on her cruise to Formosa, against a very moderate monsoon, she made fifty miles one day and one hundred the next. The Alert, another of the eight sloops, hardly equals the Ranger in speed, although the contract required these vessels to go ten knots an hour. The Monongahela hardly reached the station before her boilers were found to need very extensive repairs. The only efficient ships on the station seem to be the double enders Monocacy and Ashuelot and the tug boat Palos. These vessels have performed more cruising within the last year than all the rest together. It is hoped the Richmond, after being almost rebuilt, will reach the station in a seaworthy condition; but with a botched screw, and boilers in the same condition as the Alaska's, she will probably be a "lame duck" all her cruise.'"

Leaves and their Functions.

A recent lecture at the Royal Institution, by Mr. W. T. Thiselton-Dyer, was devoted to leaves, well illustrated by remarkable plants. Leaves are an outgrowth of soft cellular tissue, originating near the growing point of the stem. The tissue arches over and forms the buds, from which leaves and flowers are developed, with much variety of structure, form, and position, and great diversity of function. The leaf consists of a delicate skin or epidermis (abounding in breathing pores, stomates), and layers of closely packed cells, filled with green chlorophyl granules (green protoplasm), with air spaces between them. The leaves afford a large surface to the influence of light and air. It is supposed that chlorophyl, under the influence of sunlight, separates the carbon from the carbonic acid in the air, gives back the oxygen, and, by combining with oxygen and hydrogen, the component parts of water, forms starch, from which sugar, oils, and fats are derived by chemical changes. The gaseous food of plants is taken in by the leaves; the liquid food, containing nitrogen (an important element in protoplasm) and many mineral substances, is absorbed by the roots. From these albuminoids and alkaloids are derived. Many plants are nourished by decaying animal and vegetable matters; some, such as the Nepenthes or pitcher plant, are provided with suitable digestive organs. When raw meat, for instance, is laid on the digesting surface, a fluid is secreted by which the food is dissolved and absorbed; and an increased number of seeds are produced by plants so nourished. By the hairs on the leaves of Venus' fly-trap the insect is caught, and afterward dissolved and assimilated. The transpiration of the water taken in by the roots is an important function of leaves. By this evaporation it is said that a sunflower gives off, through the stomates, a quart of water in twenty-four hours. The circulation is slow in the cells of the plant, but rapid along the walls of wood cells which have no protoplasm. The erect position of plants is attributed to the turgescence of the cells when filled with water; their drooping condition, to deficiency of the liquid. In conclusion, the lecturer alluded to the phenomena of the irritability of plants, as shown in the sensitive plant, Mimosa pudica; and to what is termed the sleep of plants—shown in two plants, brought under cover from Kew that day. One remained with its leaves closed, the other was awakened by being placed in sunlight. The cause is mysterious, but probably arises from the action of a stimulus creating movements in the molecules in the protoplasm of the cells.

A SCREECH-OWL took possession of a box at Lancaster, Pa., the other day, in which a pair of martins were building their nest, and when they returned would not let them enter. The birds soon flew away and returned with a whole army of companions, each bringing in his beak a piece of mud, with which they hermetically sealed the entrance of the box. When the box was opened a few days later, the owl was found to be dead.



UNSINKABLE STEAM VESSELS.

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LEVER AND CAM VALVE.

The mechanism of the valve represented by Figs. 1 and 2 differs materially from that in more general use for the purpose of regulating the flow of steam, water, oil, and gas. The ordinary globe valve and common tap are familiar to all; in the former, five or six complete turns of the hand wheel are necessary to fully open or close the circular seated valve; in the latter the plug must be turned half a revolution for a full opening or closing. In the valve here shown the opening and closing are effected by one quarter turn of the lever handle or wheel, whichever may be used. Fig. 1 is a perspective view of the exterior, and Fig. 2 an interior view, showing the valve and the valve chamber. The operation is as follows: The gate, A, moves on guides, B B, which are arranged to prevent friction by keeping the gate when moving from contact with the seat and wall of the

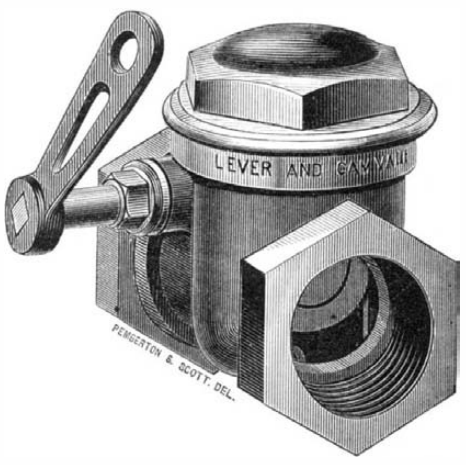


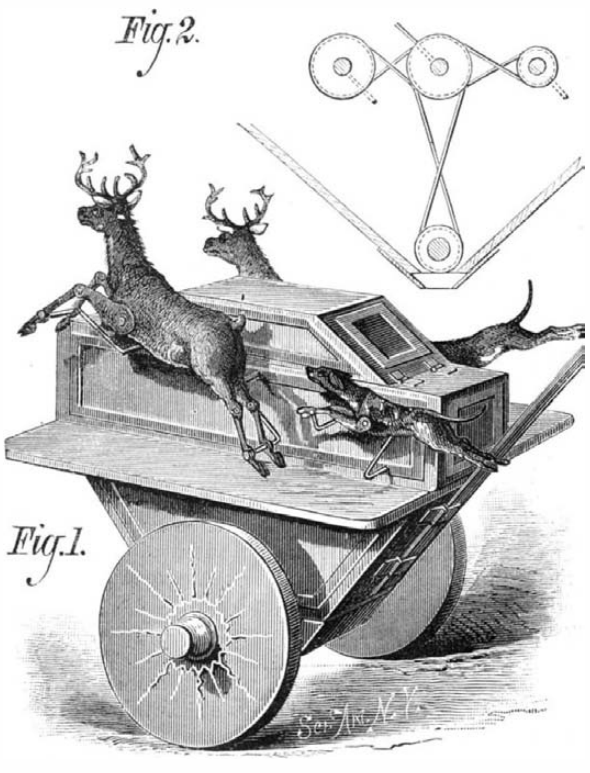
Fig. 1.—LEVER AND CAM VALVE.

valve chamber. The gate is opened and closed by means of the lever arm, C, attached to the rock shaft, D, and working in the slot, E. When the gate is nearly down, the cam, F, forces it forward and down to its seat. The advantages claimed for this mode of construction are that by the removal of the large cap every part of the valve is visible and can be examined, dirt and chips can be easily removed, and there is nothing in the valve itself to get out of order. There is a straight open passage the full size of the pipe. It is compact, as it only occupies one half the space of ordinary valves, and is so made that all the pressure bears on the back of the gate, and is therefore utilized in keeping the valve tight. There is freedom from friction. As soon as the gate leaves the seat it is entirely free. The wear of the packing in the stuffing box is very much reduced. The position of the handle shows at all times the position of the gate. In many positions in which valves have to be placed out of easy reach the lever movement may be readily operated by a rod or chain; and although the movement is quick, from the fact that it begins to shut off the flow of the fluid at once, but does not completely do so until the gate is fully closed, all water hammering or violent concussion is avoided.

Valves of this description are at present constructed from half inch to four inches in diameter, and are applicable for steam, water, oil, gas, etc. Special valves are also made for use on the Swift Connecting Fire Stand Pipes. They are made by John S. Leng, No. 4 Fletcher street, New York city, who may be addressed for further information.

AN INGENIOUS TOY.

An ingenious mechanical contrivance, which may be used



as a toy for children, or, by simple modification, as an attractive sign for dealers in sporting goods, is represented in the annexed engraving. It represents a deer chased by a hound, and to both animals a rapid life-like motion is given by means of the arrangement of gearing shown in Fig. 2. The revolution of the wheels when the toy is dragged along by the handle sets the pulleys in motion, or when the device is used for a sign the wheels might be rotated by a miniature engine. The invention is attractive and amusing, and should be popular among the children

For further information address the inventor, Mr. J. R. King, 182 Robert St., St. Paul, Minn.

MILK AS A SUBSTITUTE FOR BLOOD TRANSFUSION.

Notwithstanding the fact that the possibility of preserving life by means of the introduction of the blood of a healthy individual into the circulation of one suffering either from great loss or impoverishment of the vital fluid has been known from the remotest antiquity, and that the operation of "transfusion" has been practiced with more or less frequency from those periods up to the present time, and often with good results, and despite the fact that nearly every physician readily admits the great advantages to be derived from the operation in many cases, it must be admitted that we hear of remarkably few instances where it is resorted to, even by its most strenuous indorsers. Even in a large city like New York many of our boldest and most skillful surgeons have never ventured to perform the operation, preferring to take other chances of saving the patient's life rather than risk the dangers and difficulties attending the transfusion of blood. The great tendency of blood to coagulate, and the known fact that a particle of serum or of a small quantity of atmospheric air entering the circulation during the process is sufficient to cause death, seems to deter the boldest from hazarding the experiment except in desperate cases. Could another vital fluid be found free from the disadvantages that attend the use of blood, while possessing all the life-giving properties of the latter, it is manifest that it would prove a great acquisition to the practice of surgery, and tend to make a procedure now little used much more popular, with results prolific in good. Dr. T. Gaillard Thomas has communicated to the New York *Medical Journal* a paper to prove "that in the milk of the cow, and probably also in that of other mammals, we possess just such a fluid." Dr. Thomas' paper is given up chiefly to the presentation of cases in which the injection of milk into the venous blood as it goes to the heart, has been tried by him upon the human being with marked success. But before describing these successful experiments he proceeds to silence the prejudice that would naturally arise to such a proceeding, by pointing out the fact that while chemically inferior to blood, which is identical with the fluid to be augmented and improved, milk is more allied to chyle (the material of which nature makes blood) than any other fluid with which we are acquainted; and in injecting milk into the veins we are imitating nature very closely in one of her most simple physiological processes.

Twelve cases are now on record in which milk has been injected into the general circulation in place of blood, 3 by Hodder, 2 by Howe, 7 by Thomas. In one instance only did evil results insue (one of Howe's cases), and this should hardly be considered, since decomposed milk was employed; and this, like decomposed blood in "transfusion," would almost surely be followed by fatal consequences.

Basing his conclusions, then, upon his experience, and in no degree whatever upon theory, Dr. Thomas sums up as follows:

1. The injection of milk into the circulation, in place of blood, is a perfectly feasible, safe, and legitimate procedure, enabling us to avoid the dangers and difficulties of the latter operation.

2. None but milk removed from a healthy cow within a few minutes of the operation should be employed. Decomposed milk, like coagulated blood, is poisonous, and should not be used.

3. A glass funnel, with a rubber tube attached to it, ending in a small canula, is better, safer, and more attainable than a more elaborate apparatus, which is apt, in spite of all precautions, to admit air to the circulation.

4. The intra-venous injection of milk is infinitely easier than the transfusion of blood. Any one at all familiar with surgical operations may practice it without fear of great difficulty or of failure.

5. The injection of milk, like that of blood, is commonly followed by a chill, and rapid and marked rise of temperature; then all subsides, and great improvement shows itself in the patient's condition.

6. Lacteal injections need not be limited to cases prostrated by hemorrhage, but may be employed in disorders which greatly depreciate blood, as Asiatic cholera, pernicious anæmia, typhoid fever, etc., and as a substitute for diseased blood in certain affections which immediately call for the free use of the lancet, as puerperal convulsions, etc.

7. Not more than eight ounces of milk should be injected at one operation.

In conclusion, Dr. Thomas states that after lengthy consideration and considerable experience he would be false to his own convictions if he did not predict for "intra-venous lacteal injection" a brilliant and useful future.

Dr. Brown-Sequard.

The eminent physiologist, Dr. Brown-Séquard, has been selected as the successor of Claude Bernard in the professorship of the College of France. The qualifications of Dr. Brown-Séquard for the vacant office are beyond question, and his appointment will be hailed as a graceful recognition of scientific work not yet adequately appreciated. Perhaps few individual investigators have done more to elucidate the obscure features of brain and nerve organization than Brown-Séquard; certainly scarcely any physician has contributed so largely to the understanding and rational treatment of morbid conditions. The profession in England, and we believe on the continent, will be gratified by the choice which has been made; and science will look with confidence for the completion of investigations which Dr. Brown-Séquard has still on hand.—*Lancet.*

Odd Uses of Paraffin.

The cheap chocolate cream drops sold by peddlers on the streets are treated with paraffin to give them gloss. Chewing gum is made of paraffin, and one manufacturer thus consumes 70,000 lbs. of the material yearly. Paraffin is

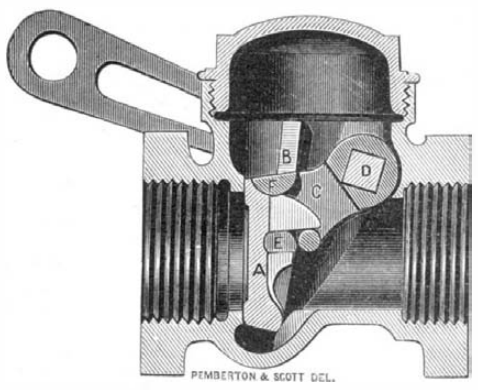


Fig. 2.—LEVER AND CAM VALVE.

also used for impregnating match sticks, sizing various fabrics, coating the interior of wine and beer barrels, preserving fresco paintings, and waterproofing silk. For the last purpose it is dissolved in naphtha, and it is said that ice cream may be spilled on rose or violet colored silk so prepared without injury to the fabric. In the south of France paraffin is now largely used to replace lard in retaining the odor of flowers, by being fused with the petals.

American Institute Exhibition.

The forty-seventh exhibition of this Institute will open September 11, in this city. Parties having novelties which they intend to bring to public notice should at once address the General Superintendent for blanks and information. The medals, it is said, have been increased, and special awards will be made upon a number of articles.

Solidification of Petroleum,

A most curious effect on even the lightest petroleum oils is produced by the addition of powdered *Saponaria* (a herbaceous plant belonging to the family of Caryophyllus). On digesting the powder in water and mixing it with the oil the latter forms a very thick mucilage, so that the flask in which the experiment is made may be inverted without its contents flowing. It is still more singular that if a few drops of carbolic acid be added and the mucilage agitated it becomes in a few minutes perfectly limpid.

A SIMPLE FIRE ESCAPE.

The annexed engraving represents a simple fire escape of English invention, its object being to catch persons who are compelled to precipitate themselves from the upper stories of burning buildings. It consists simply of a net sustained on poles, which are held up by persons on the ground. Con-

trivances of this kind kept at police stations ready for instant use on an alarm of fire, might be the means of saving many lives.

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Communications.

Mr. Edison on the Microphone.

To the Editor of the Scientific American:

In reply to the communication of Messrs. Pitt and Dopp, which appeared in your issue of June 29th, under the heading of "The Microphone," I wish to say that had the above named gentlemen read carefully what I have said in regard to the variation in the electric conductivity of carbon and other semi-conductors when subjected to pressure, they would have saved themselves the trouble of writing you. I stated, and proved, nearly two years ago, that conductors of electricity when finely divided and moulded in the form of buttons varied their resistance by pressure, and subsequently that the whole effect was due to surface contact, and not to inter-molecular action. Mr. M. Richards, of the Colt s Arms Co., also came to the same conclusion over a year ago. The explanation offered by Professor Hughes, which your correspondents referred to, is capable of being shown as absurd, and only tends to prove that he did not gain his information by experimental research, but simply by piracy.

T. A. EDISON.

Menlo Park, N. J., June 24, 1878.

Driving Piles in Sand.

To the Editor of the Scientific American:

Your correspondent states in your issue of the 22d of June that he drove a large number of piles through sand in Pensacola, and intimates that the failure of others was due to the puny attempts with too light hammers. When the navy yard, Brooklyn, was constructed by Mr. W. McAlpine and many thousand piles driven, there were used a steam hammer giving rapid short strokes, and hammers weighing two tons and, I believe, two and a half. Very frequently a pile could not be driven beyond a certain depth, but if after some hours' rest the pile driving was again renewed it could generally be driven several feet further. The impact of the pile had pressed out the water from the sand at the foot of the pile, the angular particles of sand interlocked and formed a series of arches that effectually resisted the blow on the pile until sufficient time had been allowed for the water to percolate in and loosen the aggregated particles. Sometimes a pile after being driven would come spontaneously clean out of the ground.

The jet of water to put down piles was first used, I believe, by me in 1852, in making the foundation of a lighthouse in water in Pungateague Bay, in the Chesapeake, under Major Hartman Bache. The piles were 18 feet long, hollow, 7 inches in diameter, with a trumpet-shaped base flaring out to 3 feet diameter. A 1 inch pipe was passed down through the pile to the sand, and a hand force pump sunk the pile 11 feet in about 2¼ hours. At the commencement the pile would sink through the upper stratum of sand without any external agitation; on reaching the subjacent blue clay it would remain stationary for some time, until the permeated clay would ascend the shaft and overflow at the top. Fourteen piles forming the foundation were sunk in two days. Some years subsequent a patent for this process was taken out by somebody in England. CHARLES PONTEZ.

Omaha, Neb., June 19th, 1878.

Is our Globe Hollow?

To the Editor of the Scientific American:

I see an article on a subject on which I wrote you more than a year ago, in the current number of the SCIENTIFIC AMERICAN, namely, "Is our Globe Hollow?" I would say yes, and here is my reason, given in the article which I sent you May 8, 1877:

"In or about the year 1826, Sir Richard Phillips propounded the theory that what is called gravitation is the result of the annual and diurnal motions of our globe. He says: 'If a progressive motion acted alone on a mass, it would form a train of the rarer parts, and disperse them. If a rotative motion acted alone, it would direct the parts in tangents, and disperse them. Their combination directs the parts to the center, and the two become a force of aggregation, centripetal force, gravity, or weight.'

"Admitting the correctness of this theory, it follows that if the two forces were equal, they would neutralize each other at the center, and our globe would be solid. If they were unequal they would be neutralized some distance from the center, and the globe would be hollow. As the annual motion is much greater than the diurnal, it seems reasonable to suppose that the dispersing force is also greater. If the dispersing force of the annual motion be represented by 12 and the diurnal by 8, a hollow of 8 would be the result. Not having seen a single argument in support of the hollow globe theory, this is sent for the consideration of your readers, as the only theory imaginable.—A. R."

Washington, Texas, June 19, 1878. JOHN ALEXANDER.

The Best Pen Wiper.

To the Editor of the Scientific American:

Take a few sheets of the softest tissue paper you can get, and fold and roll them all together into a bundle about eight inches long. Put an india rubber band around the middle of the roll, and then cut off the tops so as to allow insertion of pen for wiping, making the packet into hour glass shape. The advantages I find are that it cleans the pen better than anything I ever saw or imagined. C. F. S.

THE ETIOLOGY OF ASIATIC CHOLERA.—A NEW THEORY.

BY BELLEROPHON. MADRAS: HIGGINBOTHAM & CO., 1878.

All the way from Madras comes a neat pamphlet bearing the above title. The author, although intrenching himself behind the title page motto, "*Honi soit qui mal y pense,*" nevertheless invites criticism; such as we have to bestow may be expressed in a few words.

After carefully clearing Mr. Bellerophon's "theory" from its investiture of very bad orthography, etymology, and syntax, we have at length succeeded in laying bare his idea, and of this our limited space permits us to exhibit the skeleton only.

It seems that Mr. Bellerophon, after a course of personal observations and reflections, extending over a period of four years (although he states that it took him but forty days to write his essay), has been led to believe that visitations of cholera follow in the train of great battles, or in that of a sudden and widespread mortality among cattle. The corpses, having undergone putrefaction, are at length reduced to an ultimate poisonous, pulpy mass, "teeming with infusoria and animalcules in every stage of development, deposited constantly in such numbers that myriads of them may be attached to a single grain of dust." This matter, which then sinks into the underlying soil, he calls a "binomial poison (A + B);" furthermore, for the sake of distinction, he gives it a name, "Necrophagine." The soil saturated with the "necrophagine" having become dry, is afterwards wafted on the wings of the wind to the uttermost parts of the earth and falls almost anywhere, totally regardless of consequences. Should part of it, however, get wet during its flight, then a remarkable phenomenon takes place, and its "binomial" nature exhibits itself; for while the dry portions may be producing an epidemic of cholera in one portion of the globe, the damp portion, deprived of its "ichorous" matter, undergoes a change, and the germs of which it is composed develop into a secondary form of existence—entomozooids capable of engendering foot and mouth diseases in cattle that feed on food in the vicinity where it fell.

"At the same time the sceptic (*sic*) portion (that is, the A in the binomial quantity) has been diluted and partially decomposed, and being swept down streams it percolates into wells and reservoirs and causes an epidemic typhoid." A portion of the B in the binomial quantity undergoes a development likewise and produces an abundance of flies, mosquitoes, and other insects from the germs which were deposited contemporaneously with the necrophagine (!). This horrible cholera poison may be taken into the system by means of drinking water, and even "the rinsing of the mouth or of a glass in which wine or any other drink is given, cleansing the teeth with a brush dipped in water containing it, or bathing in that water, may possibly leave a particle on the gums or teeth or lips which by subsequent salivation can be taken into the system." So it becomes "possible for people who have never drunk any water all their lives (!) long to take the poison that is in the water, nevertheless, and die of it." It becomes at once evident, then, that water is a beverage that should be regarded with suspicion, and its use prohibited on sanitary grounds! The author remarks that "the two most inexplicable pathognomic symptoms of cholera are: First, the denudation of epithelium, and second, the flowery (*sic*) or pasty coating found in the duodenum or in the lower parts of the smaller intestines."

The *modus operandi* of the "necrophagine" to produce these results is thus stated: "The binomial poison becoming diluted, the infusorial germs begin, under human heat, to show signs of vitality in the stomach; meantime a portion of the diluted sceptic (*sic*) fluid would by endosmose enter the system, and if it does not cause symptoms similar to those of the disease *cellulitis venenata*, an incipient malaria would be the result. The poison passing lower down the intestinal canal, more of it would enter the circulation, while the animalcules play upon the epithelium, causing a double irritation.

'The action of the ichorous matter would be to separate the serum of the blood from the parts that would afterward coagulate. The serum would be discharged into the stomach and intestines—the lacteals would at the same time discharge a part of the chyle they had taken up, a portion of which in a curdled state would mix with the serum and present a rice-water-like appearance in the evacuations. Then the irritation by the animalcules (which would burrow like a species of Hippa), combined with the efforts of the system to rid itself by abrasion (that is, the stomach and intestines working in the same way inwardly as a man might rub or chafe, or scratch himself outwardly through an itching, by working his arm against his bare body) would result in what has been termed the *denudation* of epithelium" (!).

Such, to be as brief as possible, is the gist of this "New Theory." Criticism on this work is hardly necessary, but a few words of kind advice to the author may not be out of place. We would recommend him, then, before he elaborates the "necrophagine theory" any further, to obtain a few textbooks and make himself familiar with some of the most elementary principles of physiology and natural history, of which he now appears to be ignorant. This done, he may possibly by hard study and close observation give to the scientific world, in the course of time, some ideas on the disputed causes of the Asiatic cholera which shall prove truly worthy of attention. And that he has peculiar facilities for making such observations lies in the fact that he resides in a region where (to use his own words) "cholera hovers perpetually like an incumbent nightmare."

Diagnosis.

That we may form a diagnosis it is essential that we possess a theoretical knowledge of disease. We must find out what the patient suffers from if we want to relieve him by rational well directed treatment. If it were true that every disease has its specific remedy—an exploded notion—it would still be necessary to find out the disease in order to meet it by its appropriate remedy. And if we could not discover the disease, we might still, on the good old empirical plan, make a shot at it by firing into it a volley of remedies, counting that perchance one among them would hit the doubtful mark. "Every bullet has its billet" should be the maxim of the empirical practitioner. Since, however, we are not always able to realize the first rational indication to detect the disease, we may for a time fall back upon the plan of observing how the whole system labors, and how any particular function is in difficulty. This will furnish a provisional indication in treatment. Medication on this principle is usually safe, and ought to be safe. Two or three rules of practice will carry you a long way. Thus, when in doubt, give salines. There is hardly any disease in which salines will not do good at the beginning. There is hardly any disease in which they will do harm. By giving salines you gain time for observation, for finding out the more precise indications for treatment. The next rule—it ought perhaps to be the first—is, enjoin rest. The Pharmacopœia contains no remedy of so much value, of such universal application. In addition to its other advantages, it has the merit of giving time for leisurely observation. The third rule might be to relieve any organ suffering from difficulty in the performance of its function. But this rule requires to be followed with great discretion. For example, it is not always wise to purge because the bowels are not relieved. On the contrary, opium may be indicated, as in intussusception. And you may often greatly relieve one disabled organ by inducing other organs to do at least a portion of its work. If you observe these three precepts, you will fulfill the fourth great maxim—the maxim, great in its positive good because great in its negation of harm, laid down by Hippocrates. If you do not see your way clearly to do your patient good, take care at least that you do him no harm.

Your first interview with your patient is your opportunity. A mistake made at this critical moment may damage yourself as well as him; and he may give you no opportunity of retrieval. Later on you may make a mistake, and the consequences, to yourself at least, may be less difficult to get over. Take care, then, of your first step. Start quietly; proceed warily. Do not put your faith in intuition. Distrust those who "see through a disease at a glance." They are shallow people, and are easily seen through themselves. The motto of the true physician is "Thorough."

Now we may proceed to diagnosis. Guided by the principle that when a part of the body is diseased the whole suffers, we must examine the condition of the body in its parts and as a whole. This makes it necessary to examine with method. What is the best method? I do not think myself competent to say. But I can point out one which will fairly answer in practice. The history, diathesis, inherited or acquired, and the antecedent diseases stand on the threshold of the inquiry. These disposed of, examine the functions and organs in a certain regular order: (1) Aspect, plumpness, color and state of the skin generally; (2) the circulation, pulse, respiration, and temperature; (3) nutrition, the tongue, appetite, digestion, stomach, intestines, defecation, and bile; (4) the urinary organs, the kidneys and bladder, as to pain, as to retention or other characters, as well as the characters of the urine itself; (5) the nervous system, sleep, motor power, general languor or exaltation, excito-motory system, mental state, delirium, pain, and its seat and kind; (6) in women, the sexual organs, the menstrual function, child bearing, and the secretions.

All these phenomena should be, as far as possible, explored by the aid of manipulation and the appropriate instruments of exploration. It is a dangerous thing to form a subjective diagnosis; it is a dangerous thing to accept your diagnosis from the patient. Until recent times, however, all diagnosis of uterine disease was subjective. The result was hopeless ignorance, causing disastrous errors. And so it was to a great extent in nearly all diseases before the stethoscope, thermometer, sphygmograph, test tube, and microscope came into practical use.

The advantages of pursuing some such method as that which I have just pointed out to you are—1. You are not so likely to overlook what you are in search of. 2. You will not seldom detect complications, that is, associated diseases in addition to that, the most obvious and apparently urgent one, which, as the French say, "*saute aux yeux.*" 3. You avoid the serious mistake of going over the ground two or three times—of beating about the bush. It gives a bad impression to your patient if you ask him the same question two or three times, when he has already answered it. He will be apt to conclude that you are talking at random, and have no clear idea of what you are about.

You may ask, Why have I, who am specially called upon to aid you in studying gynæcology, touched upon all this? Simply because there is, in truth, nothing more special in gynæcology than there is in the study of heart disease, lung disease, or any other disease. All disease must be studied on the same principle and after similar methods. A long process, you will say. But practice enables one to go through much of this long inquiry quickly, and in the course of other inquiries.—*Dr. Robert Barnes.*

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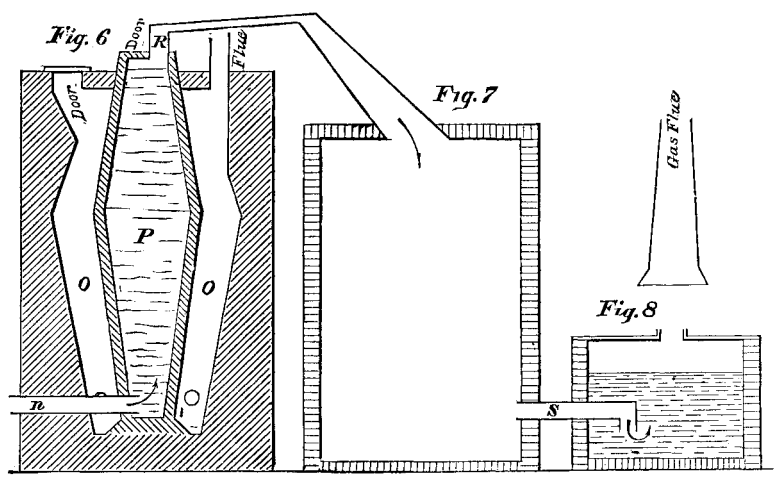
PROPOSED PROCESS FOR THE FIXATION OF ATMOSPHERIC NITROGEN.

BY JOHN BLAIR.

The first part of this process consists in freeing the air of its oxygen, and this is accomplished in the following manner: The furnace, *a*, Fig. 1, is filled with coke, and is then ignited through the door, *d*. Air is then blown through the tweers, T T, which passes up and causes the combustion of the coke. The oxygen of the air is now converted into carbonic oxide; and the latter gas, together with the nitrogen, passes up through tube, B, and into the filter, Fig. 2. The interposing layers of broken stone which are placed in the filter prevent any of the carbon dust from entering the conduit, *c*. The gases now pass into the furnace, E, Fig. 3; this furnace is filled with iron ore, which is heated by an outer furnace, D D, to a temperature of about 1,200° Fah. The carbonic oxide passing up through the heated ore reduces the latter to the spongy metallic state, and is itself converted into carbonic acid. We have now, at this stage of the process, a mixture of nitrogen and carbonic acid gas, which passes onward through tube, *g*, into the tank, Fig. 4. This last tank contains lime water, which is kept circulating through it, in order to keep it cool as well as to renew the lime solution, so that the carbonic acid may be more readily acted upon when it is brought in contact with a fresh supply.

The nitrogen gas is withdrawn through tube, *k*, by the pump, Fig. 5; an upward stroke of the piston opens the inside valve, L, and admits the gas into the cylinder, as shown by the arrow; and the downward stroke expels it through tube, *m*. This tube conducts the gas to the gas holder, where it is stored for use. (This part of the apparatus is not shown.) In the second part of this process the collected nitrogen is fixed to a metallic base. The nitrogen passes from the gas holder, through the conduit, *n*, into the furnace, P, Fig. 6. This furnace contains a mixture of potash and charcoal, which is kept in a state of fusion by the outer blast furnace, *o o*. The potash and carbon having now attained a high temperature, the potash gives up its oxygen to the carbon, and passes off as carbonic oxide. The nitrogen then combines with its equivalent of gaseous carbon, and passes to the state of cyanogen. The latter gas then absorbs its equivalent of potassium, and the cyanide of potassium is produced. The volatilized salt now passes up through the pipe, R, into the chamber, Fig. 7, where it is permitted to condense. The gases generated in the reaction pass out through the conduit, *s*, into the vessel, Fig. 8. This vessel contains an acid solution of iron, and should any of the uncondensed cyanide pass out through the conduit, *s*, into the iron solution it is immediately absorbed and forms prussian blue. The uncondensed gas now escapes through the expansion valve at *v*, and the process is complete.



BLAIR'S NITROGEN APPARATUS.

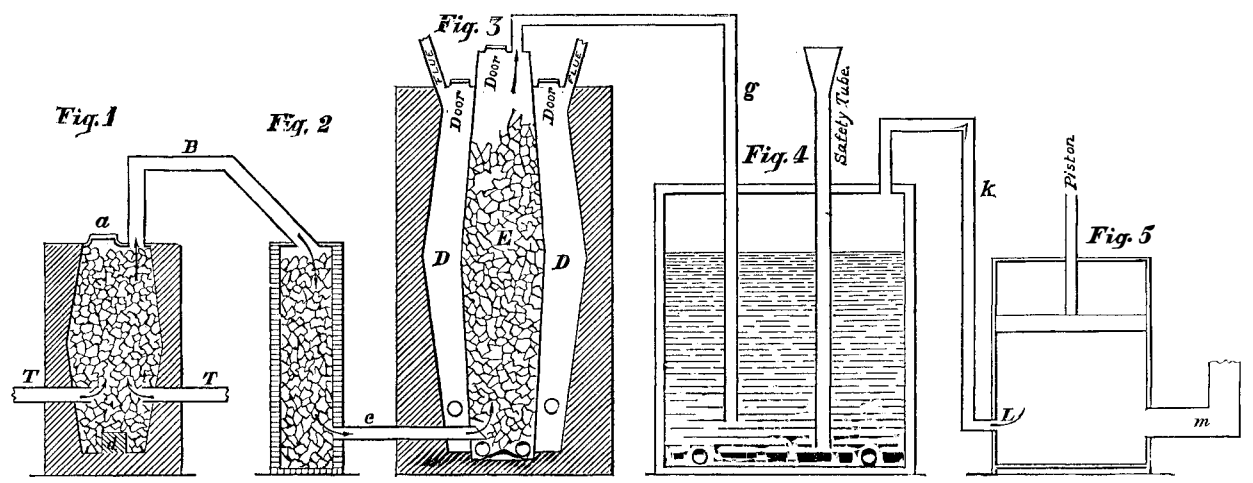
Hallucinations.

In a recent lecture, Dr. H. Maudsley says that one striking feature observed by medical men who have had cases of hallucinations under their charge is that the patients cannot be convinced that the objects they see, the sounds they hear, and the smells they perceive, have no real existence, and that the sensations they receive are the result of their excited nerves. It frequently happens that a person who suffers from hallucination in respect of one sense has the others unaffected, and is on all other matters perfectly sane. Hearing is most frequently affected, and sight next. Several interesting cases were referred to: one of a gentleman actively engaged in business, who believed his body continually gave an unpleasant odor, and consequently kept away from everybody as much as he could, and when he was assured that people did not perceive it, always replied that they were too polite. Hallucination may arise either from an idea on which the mind has dwelt, appearing as something exterior, or from excitement of the sensory ganglia. It is said that Newton, Hunter, and others could, at will, picture forms to themselves till they appeared to be realities. A successor of Sir J. Reynolds, Dr. Wigan records, had the power of painting portraits after seeing his sitters but for a short time at one visit only, and was able at will to reproduce them to himself as exterior realities. As years advanced, he found he could not dismiss these forms as he could recall them, and he began to fancy himself haunted, and was for many years in an asylum.

THE honorary degree of Doctor of Philosophy has been conferred on Mr. Edison by Union College.

Perils of Base Ball Playing.

The actuary of a life insurance company has prepared a table of statistics full of matter, deep and dangerous, regarding the mortality and casualties resulting from too assiduous attention to mastering the national game. His figures show that during the ball season in this country the monthly death rate from ball playing is 0·04; the number of cases of concussion of the brain is 4·7; incipient heart disease, 5·103; dislocation of the hip, 0·01; fracture of the shoulder-blade, 1·01; compound fracture of the sternum, 0·0002; broken ribs, 25·012; dislocation of the spinal column resulting in permanent disability, 0·00001; fracture of the arm, including forearm and above the elbow, 19·3; dislocation of the elbow, 7·05; sprained wrist, 47·07; broken fingers, 352·02; fracture of the hip, 0·03; dislocation of the knee, 1·006; sprained ankle, 15·03; injuries to the foot and toes, necessitating surgical aid, but not causing permanent injury, 225·09. In addition to the above rather suggestive array which recounts injuries resulting in death or the fracture of bones, including dislocation, he demonstrates that there are 197·01 noses broken and 473·05 teeth knocked out.—*Utica Herald.*



BLAIR'S NITROGEN APPARATUS.

Music Boxes.

Musical boxes are made either in Sainte-Croix or Geneva, excepting a few unimportant factories elsewhere. The greater part of those made in Sainte-Croix are sold under the name of Geneva boxes, trusting to the name to give greater prestige, as Sainte-Croix is seldom visited by travelers, although fully equaling Geneva in the manufacture. Sainte-Croix is also noted for the manufacture of fine gold and silver watches, and many of them are sold in Geneva under the name of Geneva watches. An erroneous impression exists that Geneva musical boxes are superior to all others; the truth is that both good and bad are made in Geneva, and the same may be said of Sainte-Croix; but a fact in favor of the latter place is that the cost of living being less than in Geneva, wages in Sainte-Croix are less in proportion, and equally excellent instruments can be manufactured there at less cost.

The most important factory at Sainte-Croix is that of C. Paillard & Co., who make as many boxes as all the other manufacturers combined, and of superior quality. In this factory there are now employed about 800 expert artisans, aided by all modern improvements in special tools and machinery. Were it not for the advantages they derive from a division of labor—the firm employing a separate set of workmen exclusively in the production of each part of the mechanism—it would be impossible to have these instruments made so perfectly at prices so moderate; for the prices cannot justly be termed high when the immense amount of carefully executed and intricate work is taken into consideration.

One great expense in this business is the changing of airs in the boxes, discarding such as have become tiresome, and substituting the latest and most popular as fast as they appear. However, the standard airs, which are always popular, such as "Home, Sweet Home," "The Last Rose of Summer," etc., are always retained. They now send these instruments throughout the entire world, their greatest markets ranking in the following order: England, the United States, France, Germany, Russia. The instruments play the favorite airs of each country to which they are sent.

A musical box consists of a brass roller with projecting points; a steel comb, the teeth of which give the sounds; a spring, to give the revolving motion to the cylinder; and a flywheel or fan, to regulate the revolving motion. The rough parts, including the bed plate, the blank roller, the mainspring, the comb (tempered but not tuned), the running gear, etc., are made in large machine shops and furnished to all the box manufacturers. The music has first to be arranged for the box by thorough musical artists. The cylinder is then given to a person (generally a woman) who, with the aid of the music and a very ingenious machine, marks the places on the cylinder where the points are to be inserted. Another person then drills all the little holes, and still another inserts the points. The cylinder is then filled with molten cement, placed on a lathe, and revolved very quickly. The cement adheres to the inside surface, holding the points, and is then allowed to cool, leaving a hole in the center for the axis. On another machine the points are filed down, so as to be of equal length.

During this time the comb is given out to be tuned, the tuner having first to file the teeth, to give the proper flexibility. The tone is lowered by filing near the base, and sharpened by filing near the point. The cylinder is then set on the bed plate, and, opposite, the comb must be screwed to the bed plate. This last operation demands great accuracy, so that the points of the cylinder and the teeth of the comb will exactly meet. The instrument is now placed on another machine, which divides the bars in the same way as the original machine for marking, and a person (usually a woman) will then, according to the music, bend the points of the cylinder slightly forward, in order to secure more strength, but more especially to make the chords drop simultaneously, and cause the runs or roulades to be played evenly. All the parts are then polished, and the box is finally given to a man who regulates the dampers and revises all the parts.

There are also some fifteen to twenty minor parts, which would require too much technicality to explain to the general reader. Size increases both volume and richness of tone. A cylinder 10 inches long can be made to play 6, 8, 10, or 12 airs well, but, of course, will play 6 or 8 airs better, and with more sweetness and harmony, than a greater number. The reason of this is that more points on a cylinder and more teeth on a comb can be used for fewer airs. If a box plays 12 airs, the teeth in the comb will be twice as far apart as if it plays only 6 airs. The space between the teeth increases with the number of airs. If the diameter of the cylinder be increased, the airs will, of course, be prolonged. The manufacture of large and small musical boxes does not differ very materially in method.

At the beginning of the present century the best boxes played only one or two airs, and boxes which then sold for $25 now sell for $5. The bells, drums, and castanets have been made for musical boxes for the past forty years, but originally were placed underneath and hidden from view; they are now placed in sight, and produce a very pleasing effect. The celestial voices, which require bellows and reeds, were first placed in the musical boxes about 18 years ago. The earlier specimens of this kind were thought very remarkable, but they were very inferior to the improved boxes of the present time. Originally, musical boxes were made with only one cylinder, but about twelve years ago it was first thought possible to make them with extra cylinders, thus increasing the variety of tunes. These cylinders can easily be changed by any one, and such boxes are now in great demand. The number of cylinders is unlimited, but to be enabled to use them a different construction of the works is required. The harp-zither attachment was introduced about five years ago; it consists of paper rolled and forced to rest upon the teeth of the comb.

Electric Light Photography.

AN architectural photograph of a large building has been taken in Dundee by means of the light from a Gramme dynamo-electric machine of a power equal to 800 candles. The view was taken by fifteen minutes' exposure in a crowded thoroughfare, during a drenching rain, and within an hour of midnight. The photograph could not have been taken so well by daylight, for the falling rain would have obscured it.

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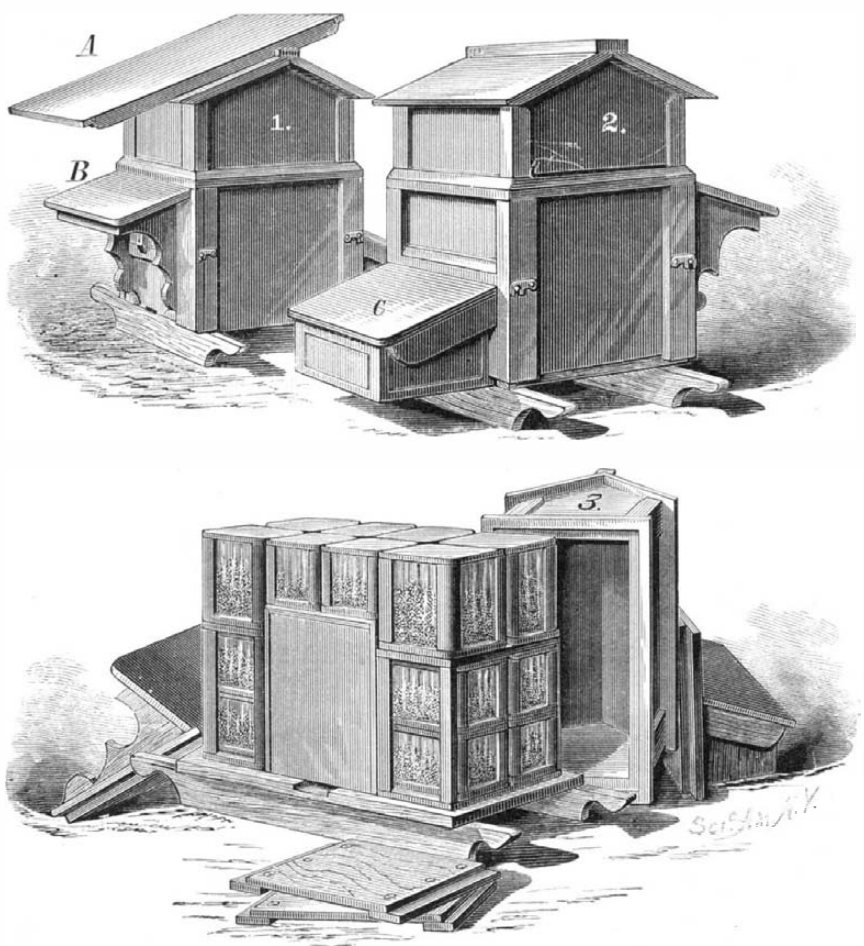
IMPROVED BEEHIVE.

We illustrate herewith an improved beehive, in which the honey boxes are easily accessible for examination or removal. Among other new features are removable shades for excluding rain and sun, and a feeding trough, so constructed that it may be supplied by an attendant without risk of his being stung. Three forms of the hive are here illustrated.

In that marked 3, there is a central box, on each side of and above which are grouped the honey boxes. The bees have access to the latter through openings in the hive, said openings having swinging covers. The hive may be a box, or it may consist of frames composed of slats suitably arranged and held together by clamping bars. The exterior walls of the hive are connected at the angles by hooks. This allows either end, or the front, back, or all sides, to be removed without disturbing the other parts of the hive or honey boxes, so as to inspect, remove, adjust, or replace the latter.

Hive 3, in our engraving, has honey boxes on top and on both sides; hive 2 has them on top and on one side; and hive 1 on top only. Surmounting the hive is a peaked roof, which is lifted off before removing the detachable sides. At A is a screen, consisting of a light frame covered with muslin or paper, which serves to protect the hive from the heat of the sun. The shield, B, protects the entrance from rain or moisture. At C is the feeding trough. The construction is strong, simple, and convenient, and the device generally is one likely to find favor with all apiculturists.

Patented April 9, 1878. For further particulars address the inventor, Mr. Charles R. Macy, Lamington, Somerset county, N. J.



MACY'S IMPROVED BEEHIVE.

A Good Act.

By the act of Congress approved June 6, 1878, "all works of art, collections in illustration of the progress of the arts, science, or manufactures, photographs, works in terra cotta, Parian, pottery, or porcelain, and artistic copies of antiques in metal or other material, hereafter imported in good faith for permanent exhibition at a fixed place by any society or institution established for the encouragement of the arts or science, and not intended for sale, nor for any other purpose than is hereinbefore expressed, and all such articles, imported as aforesaid, now in bond, and all like articles imported in good faith by any society or association for the purpose of erecting a public monument, and not for sale, shall be admitted free of duty under such regulations as the Secretary of the Treasury may prescribe."

CROSS' IMPROVED GAS CONDENSER.

We illustrate herewith a new condenser for illuminating gas, the operation of which is as follows: The gas from the retort house is introduced into the bottom of the condenser through the inlet pipe, and by the arrangement of the partitions and apertures is compelled, in its ascent, to pass in succession through all of the chambers, and over and in contact with all of the partitions, which present an extended area of cooling surface. In this way the condensation of the gas and the consequent separation of the tar and ammoniacal liquor therefrom are accelerated. The gas finally escapes from the upper chamber through an outlet pipe, by which it is conducted to the purifier. The condensed matter separated from the gas during this process falls upon the upper surfaces of the inclined partitions, and thence runs down into grooves or gutters, one of which is located at the lower edge of each partition. From these gutters the tar, etc., is drawn off through suitable pipes, one on each side of the condenser, the outlets of which pipes are sealed to prevent the escape of gas. By thus providing each partition with a separate gutter and discharge outlet the impurities deposited in one chamber are quickly carried off and prevented from dropping into the next one below, and consequently the gas in its upward passage is not compelled to pass over large accumulations of the products of condensation, which would retard the purifying process. The wedge form of the chambers causes the stream of gas to be contracted, so that when it passes through the apertures the particles of tar held in suspension are brought close together. On the gas rising into the chambers above, it suddenly expands, the lighter portion rising quickly and leaving the heavy particles upon the surfaces of the partitions, which thus facilitate the separation of the impurities.

Each of the chambers is provided at its under end with a perforated pipe, each extremity of which is connected with a vertical pipe outside the receptacle. Said pipe is connected with an elevated tank containing water or weak ammoniacal liquor, which thus enters the pipes under pressure, and is discharged through the perforations in the form of spray into the chambers, in such a manner that the gas, in its upward passage, is compelled to pass through the same. By this means it is claimed that the gas is thoroughly washed and the cooling process materially assisted. The pipes are each provided with a stopcock, by which the spray can be cut off at will from any particular chamber desired. A number of the chambers have perforated partitions extending vertically across them, and through perforations in these the gas passes. The gas is thus divided into fine streams, in which state it can be more rapidly and perfectly cooled; and as the combined area of the perforations of each partition is greater than that of the inlet pipe, no back pressure is produced. For further information address the inventor, Mr. Robert A. Cross, 9 Bow street, Charlestown, Boston, Mass.

FIG. 1.

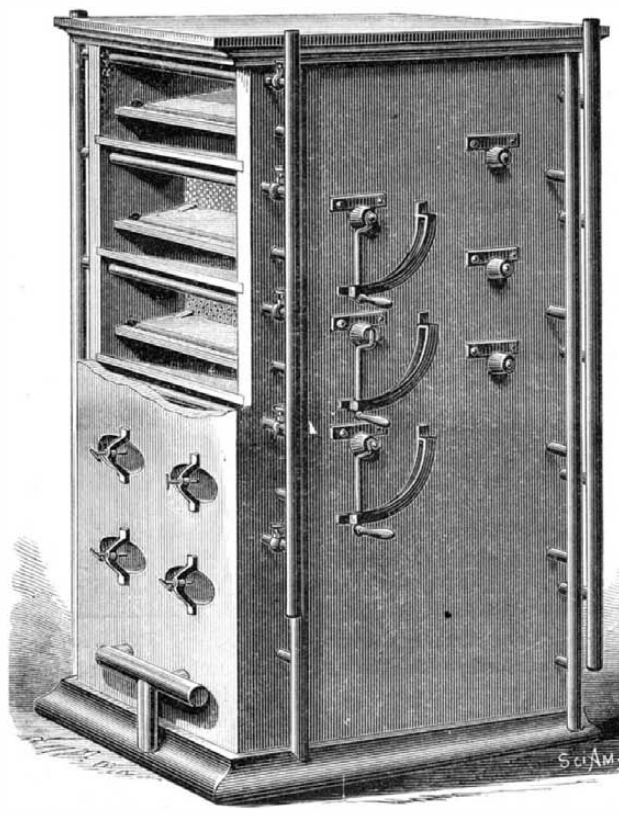
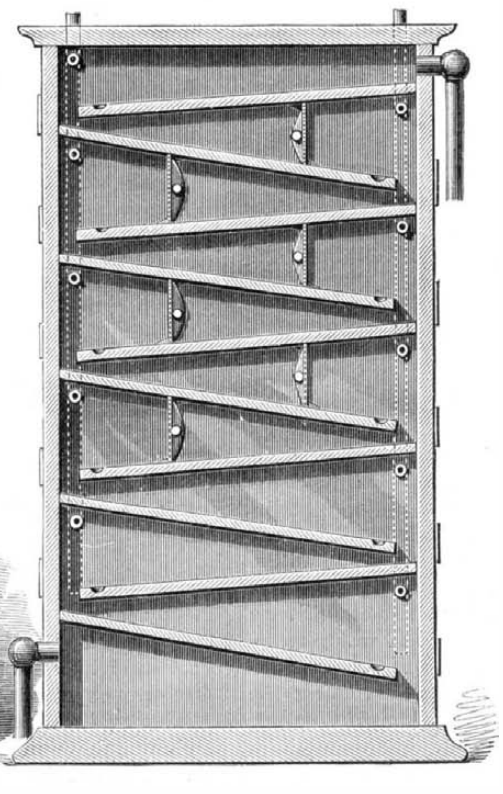


FIG. 2.



CROSS' GAS CONDENSER.

American Crop Prospects.

Mr. E. Perkins, of London, now in this country, in a recent letter, dated at Chicago, writes as follows to the London *Times:*

"The question naturally asked by Englishmen, when there is a possibility of a war with Russia, is this: Will there be a great advance in provisions, and where will the wheat usually obtained from Russia come from? As an extensive traveler in the United States—for I suppose I have traveled for at least 75,000 miles on railroads running through the wheat and corn fields of the States within the last 100 days—I will answer this question, and from a disinterested standpoint.

"The winter wheat crop in the United States has never, in the history of the country, looked as well as it does now. It is safe to say that the winter wheat crop will be at least one half greater than ever before produced in America. In traveling over 75,000 miles I have failed to see a single bad piece of wheat. By the time this letter reaches England much of the wheat—that is, all of the crop south of the line of Charleston, Cincinnati, and St. Louis—will be harvested; and by June 20 the remainder of the winter wheat crop will be harvested.

"The winter wheat crop will embrace about 75 per cent of the wheat raised. The other 25 per cent will consist of spring wheat, which will be mostly raised in Wisconsin, Minnesota, Dakota, and the Canadas. Spring wheat will be harvested about the middle of July. It is now all sown. The acreage of spring wheat, on account of rumors of a war in Europe, has also been increased at least 50 per cent.

"What will wheat be worth in Chicago in August?

"The best wheat experts agree that wheat will drop to 75 cents per bushel in Chicago in the autumn; that it will fall to less than a dollar in New York; and that any quantity the English nation may call for can be delivered in Liverpool at from $1 to $1.10 per bushel by September 1

"So you see there can be no bread famine in England if the Crimean wheat should be entirely cut off. The crop of wheat now growing in the United States, if properly distributed, would supply all Europe.

"In regard to other provisions, beef, pork, and lard, they always follow wheat and corn. They are unprecedentedly low in the United States now, and must continue to be still lower.

"I write this that you may know where England will get her supplies in case of a war, and that your people may have no cause for alarm if the wheat supply from the Crimean country cease altogether."

[75,000 miles in 100 days is quite complimentary to the speed of American railways, to say nothing of the endurance of the writer. It means a little more than 30 miles an hour, kept up night and day for about three months.]

The Launch of the Nipsic.

The United States steamer Nipsic, which has been on the stocks in course of construction at intervals for nearly five years, was recently launched at the Washington Navy Yard, in the presence of the President and Mrs. Hayes, the Secretaries of the Navy and Treasury, and a large number of other distinguished and undistinguished spectators.

The Nipsic was built to take the place of the old war ship of that name, and was designed by Naval Constructor Hanscom. Her extreme length is 201 feet; length between perpendiculars, 185 feet; extreme beam, 35 feet 5 inches; beam moulded, 34 feet; depth of hold from throat of floors to gun deck, 16 feet 2 inches; timber and room, 2 feet 6 inches; siding of frames, 10 inches; moulding size of frame at throat, 1 foot 2 inches; moulding size of frame at head, 6 inches; thickness of planking, 4 inches. She will be bark-rigged, of 615 tons burden, 1,375 by displacement. The

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length of main-mast will be 62 feet above deck; length of main-top-mast, 44 feet; main-top-gallant-mast, 23 feet; main royal-mast, 15 feet 4 inches; gaff, 27 feet; length of fore-mast above deck, 57 feet 2 inches; length of main-top-mast, 41 feet; top-gallant-mast, 21 feet 4 inches; royal-mast, 14 feet 3 inches; gaff, 27 feet; length of mizzen-mast above deck. 55 feet; length of mizzen-top-mast, 31 feet; mizzen top-gallant-mast, 15 feet; gaff, 32 feet; length of bowsprit, 25 feet 6 inches; jibboom, 21 feet; flying-jibboom, 17 feet. The Nipsic will be classed as a third-rate, and will carry four nine-inch broadsides, one eleven-inch pivot, and one 160 pounder; but, should it be thought necessary, four additional guns can be mounted. She will be propelled by compound engines, driving a Hirch's four blade screw, of fourteen feet diameter.

THE SWISS HOUSE AT THE PARIS EXPOSITION.

Our engraving, which we take from the London *Graphic*, represents the *façade* of the Swiss house on International street, in the Paris Exposition The building itself is thoroughly Swiss in its construction, being of wood tastefully colored and ornamented with the arms of the various cantons. The front is composed of three arches, that in the center serving as the entrance, and those at the sides being filled with stained glass. Above the center arch is a clock, above which stand two figures of men in armor, who strike the hours, half hours, and quarters. The illustration shows the usual large crowd which gathers whenever the clock strikes, to witness the movements of the automata.

The Ingenuity of Bees.

The Cincinnati Society of Natural History has begun the publication of a journal of its proceedings; and, in the first number, just issued, we find the following interesting note, by Mr. V. T. Chambers, on the method adopted by some bees of reaching the nectary of flowers. That humble bees frequently pierce the corolla of flowers, near its base, with their proboscis, which they then insert into the opening thus made, has long been known, and frequently mentioned. Indeed it is the usual way taken by these bees to reach the nectary when the corolla is too long for the tongue to reach the nectary from the mouth of the corolla, unless, indeed, the flower is a very large one—large enough for the bee to enter its mouth and reach the nectary in that way. Mr. Chambers remarks that if the same practice obtains with hive bees, he does not remember having seen the fact stated, and so records the following observation.

A large bush of *Weigelia rosea* was literally covered with flowers in all stages, from the unopened buds to those that were withered and ready to fall; and great numbers of bees swarmed over them—humble bees, hive bees, mason bees, and sweat bees (*Andrenidæ*). The older flowers were each pierced near the base by a longitudinal slit, made by hive or bumble bees, which had previously visited them; and, whenever one of these bees alighted on one of these flowers, it immediately went, without attempting to enter the corolla, to the base of the flower and inserted its proboscis into the slit already made; or, if the flower was a fresh one, having no slit, it proceeded immediately to make one. By the humble bees this was instantly effected without trouble, but to the hive bees it seemed to be more difficult—probably because the blades of the maxillæ, which are used to make the slit, are weaker or more flexible than in humble bees.

Of the numerous hive bees observed, only a single one attempted to enter the mouth of the corolla, and it came out without going further than just within the opening. On the other hand, the mason bees and sweat bees went in every instance straight into the mouth of the flower, and never attempted either to make a slit or to use one that was already made. Yet one of these mason bees (*Megachile*) was fully as large as the hive bees.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, July 13, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

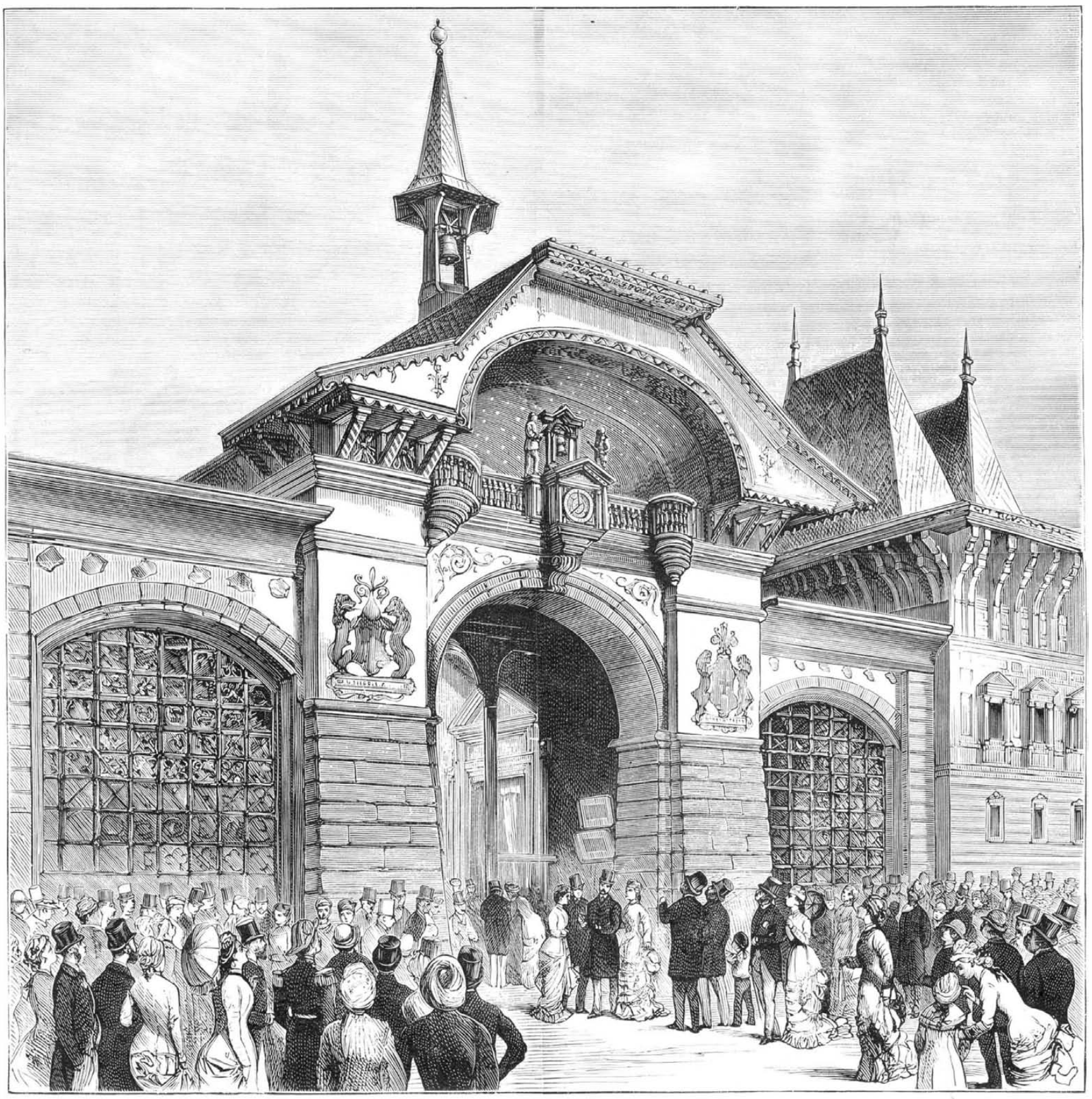
	H.M.		H.M.
Venus rises	2 14 mo.	Saturn rises	10 49 eve.
Mars sets	8 42 eve.	Uranus sets	9 19 eve.
Jupiter rises	8 10 eve.	Neptune rises	0 20 mo.
Jupiter in meridian	1 01 mo.		

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	8 44 eve.	Regulus sets	9 19 eve.
Algol (var.) rises	10 24 eve.	Spica in meridian	5 52 eve.
7 star (Pleiades) rises	0 47 mo.	Arcturus in meridian	6 43 eve.
Aldebaran rises	2 06 mo.	Antares in meridian	8 55 eve.
Capella rises	11 30 eve.	Vega in meridian	11 05 eve.
Rigel rises	4 13 mo.	Altair in meridian	0 21 mo.
Betelgeuse rises	3 58 mo.	Deneb in meridian	1 13 mo.
Sirius	invisible.	Fomalhaut rises	11 24 eve.
Procyon	invisible.		

REMARKS.

Jupiter and the moon are in conjunction July 15, 3h. 58m. morning. This will be an occultation on this continent between 16° + and 62° — lat., and here will be a very near approach, Jupiter being a trifle north of the moon. Saturn becomes stationary July 15, after which date it will retrograde, moving westward in the constellation *Pisces*. A line connecting the two eastern stars in the Square of Pegasus (Alpheratz and Algenib) and produced southward 16°, reaches Saturn, situated in a starless region. Algol at minimum July 16, 5h. 59m. morning, and 18, 2h. 48m. morning.



THE SWISS HOUSE AT THE PARIS EXPOSITION.

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THE ST. BENOIT TWINS.

One of the most astonishing freaks of nature which has ever been brought to public notice is now on exhibition at the New York Aquarium in the so called St. Benoit twins. Two children, perfect in every respect above the lowest rib, at that point literally fuse into one. The perfect lower body of one child belongs to the perfect upper bodies of two, an arrangement, so to speak, readily comprehensible from the engraving given herewith We lay especial stress on the word ' perfect," because the most phenomenal feature of the children is that with the exception of their wonderful coalescence there are no exterior signs of anything abnormal. To classify them as a monster is to do violence to one's feelings They are a pair of exceedingly pretty, healthy, wide awake babies, remarkably well developed for their age, and to all appearances possessing as good a chance for continued existence as any single infantile member of the human family In a word, nature has seemingly taken a selection of parts of the bodies of two children and neatly joined them in this odd form.

The twins were born in January last in the parish of St. Benoit. about 40 miles north of Montreal, Canada. Their parents, Drouin by name, are French *habitans*, and stout, healthy people. Their former child, a girl, now two years of age, exhibits no abnormal peculiarities, nor have such appeared in any previous generation of the family. The twins, which are female, weighed at birth 13 pounds. They have been more than usually free from the ailments common to early infancy, and at the present time weigh 22 pounds. In individuality they are perfectly distinct, no nervous connection being traceable. One sleeps tranquilly while the other may be fretting, or one may be hungry while the other is not. Each controls the leg nearest it, and aperients administered to one do not affect the other. The latter result shows that there are distinct digestive systems, which are relieved, however, by a common passage into which both open. The kidneys and bladders are probably separate, but the generative organs are, it is believed, single and perfectly normal.

THE ST. BENOIT TWINS.

The union of the bodies occurs, as stated, just below the lower rib, the fork being smooth, and the navel situated on the median line common to both. As they lie on the nurse's lap, dressed, the twins appear to be simply two babies placed side by side, heads and feet in opposite directions, or rather the appearance is as if the upper portions of the two bodies had been squarely joined, a single pair of legs protruding at one side.

The science of teratology, under which is classed these strange inter-uterine phenomena, has been the object of much careful investigation, and M. Geoffroy Saint-Hilaire, some forty-five years ago, reduced it to concrete form. He classifies monsters into two grand divisions, first, those which have the elements of only a single individual, and second, those which have the parts complete or incomplete of two or more individuals. These classes he subdivides into orders, tribes, families, and genera, on the Linnæan plan.

The St. Benoit twins belong to the second division and to the so-called *autositaires*, in which the two individuals present the same degree of development, each having an equal share of life common to both; neither lives at the expense of the other. The tribes of autositaires include the most celebrated double twins. The negresses Millie-Christine which have been exhibited lately in Europe, and which we believe are still living, now aged 27 years, belong to the first tribe, being united only at a single region at the lower part of the backs. There are, however, two pairs of legs and united intestines. Their individuality is separate, but on the other hand there is a mingling of the sensory nerves at the lower part of the spine, so that they are not such distinct beings as are the St. Benoit twins. Their members are besides in some respects deformed, while in the St. Benoit twins there is no deformity whatever, but rather a tendency to fine development. The Siamese twins belonged to a subdivision of the same tribe. They were united at the xiphoid region of the sternum, and had but a single umbilicus in the center of a moderate sized connecting process. It will be remembered that these twins had perfect bodies but that post mortem examination showed that their livers were on adjacent sides of the two bodies and were connected by the ligament, in which last there was a region of common sensibility. The second tribe of autositaires include those connected above the umbilical region, and in the third must be classed the St. Benoit twins, inasmuch as the trunks are united in a single body. We know of no parallel instance where children have lived under these last conditions, and hence it is hardly necessary to point out the high scientific importance of thorough investigation of the present case. In other respects many of the usual circumstances surrounding the existence of monstrosities are here discernible. It is not abnormal that the mother should have been in good health and previously have borne perfect children. The female sex is that which predominates in phenomena of this kind. The immediate cause is evidently absence of formation coupled with union of parts, but how engendered cannot be told. The period of gestation was normal and the presentation at birth such as to render delivery simple. The investigations which we recently published showing how monstrosities in chickens may easily be produced by the action of slight external causes go to indicate that to exterior influences on the mother are probably attributable the formation of unnatural embryos, but what these influences were in the case we have presented and what their course of action is a subject for future discovery.

Improved Method of Milling.

In the report of the Committee on Improved Methods of Milling, at the Fifth Annual Convention of the Millers' National Association, Mr. Homer Baldwin recommends an improved system of gradual reduction and thorough purification as follows: First, free your wheat of all impurities by means of separators, cockle machines, etc., then gently brushing or polishing it, thus completing the first step in purification. For reduction use stone, 4 feet in diameter, faced and furrowed with an emery wheel, and made as straight, true and smooth as skill can make them. They should have a much greater furrow surface than face, be as perfectly balanced and as well trimmed as can be done, using the best driving irons that can be obtained, sparing no pains whatever to make your stone as near perfect as possible. You are now ready for gradual reduction—run the stones slow, grind high, bolt well, and you have completed the first step in gradual reduction. Thoroughly purify your middlings, using good purifiers and plenty of them, regrind your purified middlings, bolt out the flour thus obtained, repurify the remainder, then regrind and repurify until you have reduced the middlings to flour and feed. Having used smooth stone and ground high, you cannot complete the thorough purification of your middlings without the use of rolls, iron or porcelain. I prefer iron rolls. After having carried the purification as far as you can do so with purifiers, you pass the large middlings intermixed with the germ through a set of rolls, reducing the middlings and fattening the germ, thus enabling you to complete the separation and purification. Next purify the bran and grind it, bolt out the flour, which will be a low grade, and you have the system of gradual reduction and thorough purification, and, as a result, you have a high grade of wheat flour, a high grade of middlings flour, and as high a grade of bran flour as can be made by cleaning the bran, and you have the grades all separate and can then make any mixture of the grades you desire. The wheat flour and the middlings flour mixed make the genuine straight new process flour.

A Remarkable Meteoric Phenomenon.

Mr. R. H. Earle, of St. Johns, Newfoundland, sends us sketches of a remarkable meteoric phenomenon visible in that city on the evening of April 30th last. It seems to have appeared as a serpentine tail of light having a brilliant nucleus or head. It then assumed a double form, with two nuclei, one of which apparently turned rearward and then resumed its forward motion, the whole streak meanwhile moving northward. The subsequent positions are exceedingly curious. In the course of an hour the light gradually faded away. No explanation has been sent us of the phenomenon, which seems to be of auroral nature.

Drinking Water.

Professor A. H. Church, Professor of Chemistry in the Agricultural College, Cirencester, Eng., has published a useful little treatise, calculated to be of great public service. The author speaks in the first place of water as forming part of the human body, as well as in plants and animals generally, and explains its physiological functions. He then turns to the proportion of water present in certain articles of daily food, which he illustrates by a diagram. An examination of our water supply next follows. Mr. Church explains the dangers of river water if used for domestic purposes, and the still greater risk attending the consumption of a supply from shallow wells. He gives a sectional diagram of a well sunk in a gravelly soil down to the clay, rock, or other more impermeable substratum, and in friendly proximity to the cesspool, an interchange of liquid taking place between the two according to its temporary height in each. As an instance in point, he mentions that a well which supplied several cottages with water suddenly failed. On examination the reason was soon discovered: the owner of an adjoining house had cut off the supply from a water closet, and substituted an earth closet. In all this account of shallow wells and their feeders there is nothing in the least sensational or exaggerated. In country places we have repeatedly observed the well serving for a row of cottages separated from the cesspool merely by three or four yards of gravel or chalk, sufficient indeed to remove visible impurities and confer a delusive appearance of brightness, but utterly unable to remove dissolved impurities or those minute organisms which are supposed to convey cholera and typhoid fever.

The remainder of the work is devoted to a description of the means of testing waters, and of purifying such as are more or less charged with foreign matter. As he is addressing himself not to professional men but to the public at large, he does not, of course, enter into quantitative methods, but recommends the application of a few simple qualitative tests, such as nitrate of silver, molybdate of ammonia, permanganate, Nessler's liquid, along with a careful observation of the color, transparency, and odor of the water.—*Chemical News.*

Where to Observe the Solar Eclipse of July 29th.

General Myer, the Chief Signal Officer of the Army, has done an excellent piece of work in preparing a table for the benefit of intending observers of the solar eclipse of July 29th, which exhibits the chances of weather conditions favorable for observation at the United States stations and posts within or very near the path of totality. The total number of such points within the path is 36, and in the vicinity of the same, 31. The predictions are based on data collected by the Signal Service Department. The table shows the name of the place, whether it is a government or volunteer station of observation, its latitude, longitude, and altitude, besides other useful data which contribute to the determination of the percentage of chances of favorable conditions. There is one station, Fort Keogh, or cantonment on Tongue River, Montana, where the percentage is 100, and where consequently a good observation is considered a certainty. The following stations show a percentage above 90: Walla Walla, Washington Ter.; Camp Warner and Fort Klamath, Oregon; Boisé City and Fort Boisé, Idaho; Corinne and Mount Carmel, Utah; Fort Laramie, Wyoming; Castroville, Jacksboro Fort Duncan, Fort McIntosh, and Fort Davis, Texas.

Explorations and Surveys.

Major Powell's surveys during the coming summer will be more exclusively confined to the limits of Northern Arizona and Southern Utah. The new region lies mostly south of the Grand Cañon of the Colorado river and includes the plateau country on which are situated the famous Moqui towns. The plans of the Hayden and Wheeler surveys are not fully completed, but the field of the former expedition will be in Idaho and Montana, west of the 111th meridian.

Captain Howgate's Polar colonization scheme goes over until next session of Congress, the bill authorizing the appropriation of $50,000 to carry it out having failed to pass. This unfortunately compels the return of the preliminary expedition sent out last season under command of Captain Tyson.

As a means of partially crushing grain before grinding, Mr. J. F. Gent, of Indiana, a well known mill expert, considers rolls superior to any process now in use. They are especially adapted for crushing those parts of the middlings which contain bran or germ. Chilled iron rolls are considered the best.

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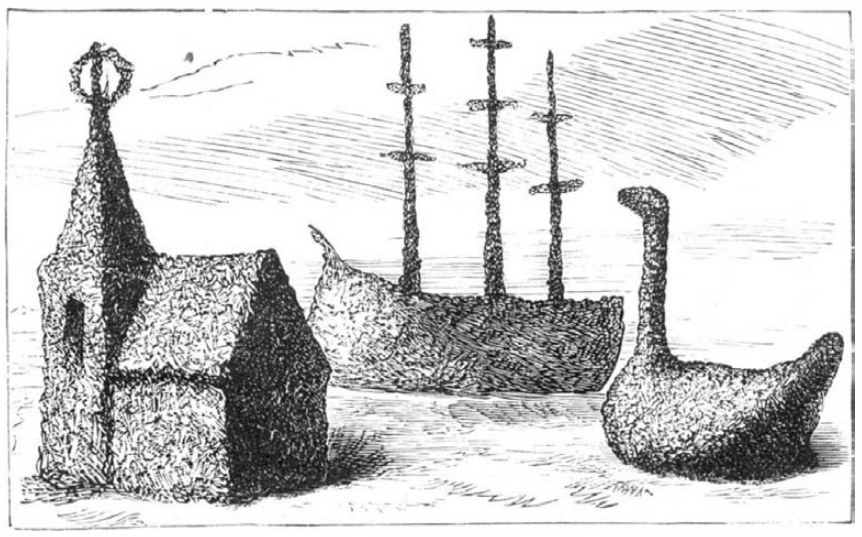
Tests for Good Burning Oil.

Professor J. Lawrence Smith, in his report as Centennial judge, says that good petroleum should have the following characteristics: 1. The color should be white or light yellow, with blue reflection; clear yellow indicates imperfect purification or adulteration with inferior oil. 2. The odor should be faint and not disagreeable. The specific gravity at 60° Fah. ought not to be below 0·795, nor above 0·84. 3. When mixed with an equal volume of sulphuric acid, of the density of 1·53, the color ought not to become darker, but, on the contrary, lighter. A petroleum that satisfies all these conditions and possesses the proper flashing point may be set down as a pure and safe article. Too much care cannot be exercised in examining this oil for household use.

CURIOUS HEDGE FIGURES.

It was the fashion, a century ago, to trim hedges and close-leaved trees into fantastic forms, resembling animals, buildings, etc. In many old gardens in France this custom is still maintained, and the visitor may walk through alleys on either side of which are high walls of dense verdure cut perfectly square, and occasionally arching overhead. At corners these fantastic figures in living green are often encountered, they being the product of the gardener's skill in training and clipping. Our engraving represents three quite large objects made in box, and exhibited growing in the Dutch Garden at the Paris Exposition.



CURIOUS HEDGE FIGURES.

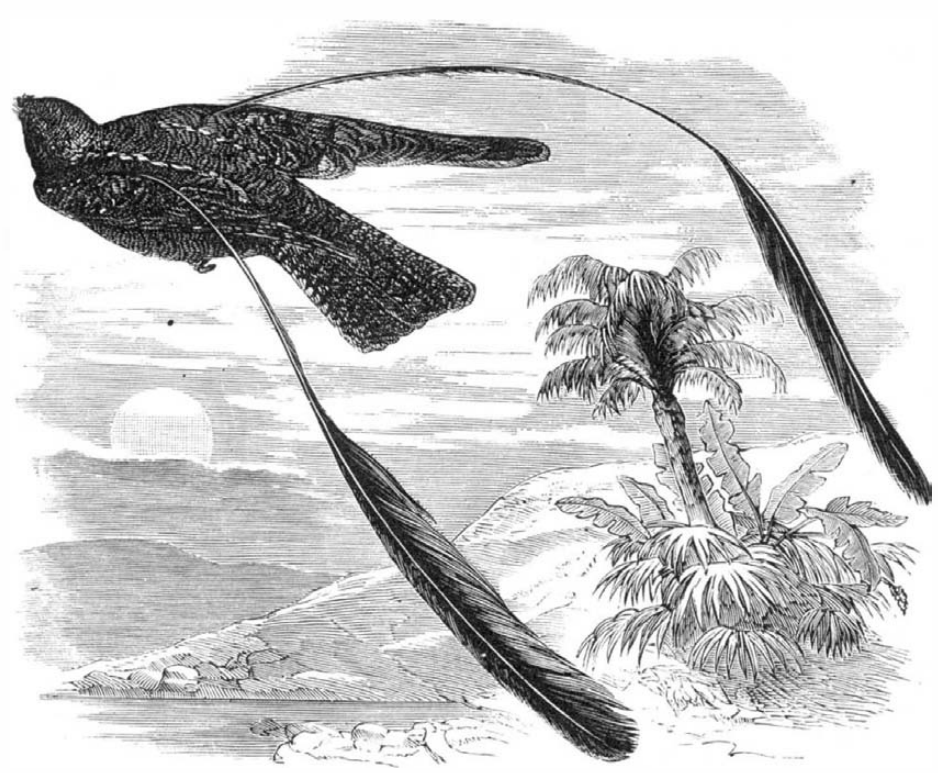
Food Supply of Paris.

There are 26 millers in the environs of Paris, St. Denis, and Sceaux, who employ 234 men. There are, in the departments of the Seine, 1,694 bakers, who employ 7,264 hands, 2,251 being females. Besides these there are 1,062 pastry cooks, who employ 3,156 men and 555 women. In the mills the men get, on an average, 7s. per day; the bakers about 5s. 6d. for men in the town, and 3s. for women; in the suburbs the men 3s. 6d., and the women 2s. 3d. The pastry cooks in Paris get 6s. for men and 5s. for women; in the suburbs 3s. 6d. for men, and 2s. for women.

THE LEONA GOAT SUCKER.

The curious feature about this bird is the long and very elastic feather shafts which rise from the middle of the wing coverts and extend to a length of twenty-eight inches. They are totally destitute of barbs except at the extremity, where they suddenly give out a broad web of four or five inches in length. The object of these odd appendages is not known. They are found only on the male bird, and evidently bear an analogy to the train of the peacock and the long tail feathers of the pheasant among the birds, as well as to the beards, horns, tusks, manes, and similar masculine appendages of male quadrupeds.

The plumage of the Leona goat sucker is very prettily marked with spots and bars of rusty red and black upon the usual brown ground. Every primary feather possesses nine rusty red spots and as many of a black hue, and there are many other spots and bars scattered over the body and wings. The bird is not a long one, measuring only eight or ten inches in total length. It is a native of Western Africa. We take our illustration from Wood's "Natural History."



Oatmeal.

Liebig has chemically demonstrated that oatmeal is almost as nutritious as the very best English beef, and that it is richer than wheaten bread in the elements that go to form bone and muscle. Professor Forbes, of Edinburgh, during some twenty years, measured the breadth and height, and also tested the strength of both the arms and loins, of the students in the university—a very numerous class, and of various nationalities, drawn to Edinburgh by the fame of his teaching. He found that in height, breadth of chest and shoulders, and strength of arms and loins, the Belgians were at the bottom of the list; a little above them the French; very much higher, the English; and highest of all, the Scotch and Scotch-Irish from Ulster, who, like the natives of Scotland, are fed in their early years with at least one meal a day of good oatmeal porridge.

Salt in Beer.

The presence of a small percentage of salt in malt liquors may be unobjectionable, or even necessary to bring out the flavor of the principal ingredients; but it is impossible to vail the fact that, whether a very saline water is selected for brewing purposes or salt be introduced in any considerable quantity during the manufacture of beer, the expedient is a device to create thirst and increase the demand for drink. It is, therefore, a matter of public interest to see that the adulteration of malt liquors with salt is prevented by the enforcement of the law. If the brewers take the hint given to them by Mr. Sclater-Booth recently, and carry a representative case to the Court of Appeal, those who are anxious to minimize that excess in drinking which constitutes a ceaseless cause of loss and injury to the working classes of this country, should see that the true nature of the adulteration is exposed. We can easily understand that beer containing an "insufficient" quantity of salt will not be profitable. It may well find its way back to the brewers, because, the thirst producing element being absent, the publican would find the article lie on his hands. The mysteries of the trade in intoxicating beverages are many and bewildering, but we venture to hope the legislature and the public are too deeply impressed with the importance of encouraging temperance to be greatly moved by compassion for the hard case of the makers and sellers of beer which cannot be sold in quantities satisfactory to its producers unless they are allowed to drug it with enough salt to render their customers inordinately thirsty!—*Lancet.*

Dr. Morfit's Method of Preserving Animal and Vegetable Food.

We have received a number of biscuits and other preparations containing preserved solid and liquid food, both animal and vegetable, which are the practical results of a new process lately patented by Dr. Campbell Morfit. They include substances of the most diverse nature, such as milk, cream, cheese, beef, garden rhubarb, cabbage, tomato, pork sausage, and a variety of other alimentary products, all of which are perfectly savory and toothsome, in spite of their being more than a year old. It is, however, more with Dr. Morfit's process than with its present results that we have now to deal, for we must look upon his discovery as being as yet in its infancy.

Dr. Morfit's experiments, which he has prosecuted uninterruptedly for the last two years, seem to prove that ordinary gelatin, when it is once thoroughly diffused through a vegetable or animal substance, and dried in and with it, will protect it from decomposition or other alteration for a prolonged period, in spite of atmospheric or climatic changes. This is clearly proved by the samples submitted to us, which —although they have been exposed to the constant changes of temperature and moisture consequent on their having been kept for more than a year in the store room of an ordinary dwelling house—are still perfectly good and sweet, their natural characteristic flavors being well preserved. Some lime fruit juice biscuits, for instance, which are more than a year old, have preserved, in a very perfect manner, the peculiar flavor by which the juice of the lime can always be distinguished from that of the lemon.

The primary principle of Dr. Morfit's process is the getting rid of nearly the whole of the natural water contained in the substance to be preserved, by submitting it to a certain degree of heat, the place of the water being supplied by gelatin. The compound is then dried, and in this state it may be kept for any length of time, or else it may be made up into biscuits by incorporating it with biscuit powder.

Let us take Dr. Morfit's method of preserving beef as an example. The beef must be as free from fat and bone as possible, and should be first stewed in its own liquor, or with the least possible quantity of water, and seasoned or not according to taste. The whole is then reduced, by any available mechanical means, to a state of smooth and fine pulp, and triturated with a solution of gelatin in water. One pound of gelatin is enough for 15 pounds of meat, fowl, or fish, the gelatin being dissolved either in a sufficiency of water or in the natural juice of the substance itself. In the case of fruit—such as gooseberries, currants, or plums —they are stoned or skinned when necessary, and cooked or not, as the case may be. They are then made into a pulp and mixed with gelatin dissolved in water or their own juice, heated so as to insure a thorough mixture of the ingredients, and then poured into coolers. In certain cases the gelatin may be replaced by mucilage of Irish moss, but the result, although cheaper, is not so good.

Dr. Morfit's method of condensing milk without the use of sugar is of great interest, seeing that the Swiss and other descriptions of condensed milk, which are now so largely sold, cannot be taken by delicate infants or by persons of weak digestion, owing to the large amount of sugar contained in them. One pound of gelatin is dissolved in one gallon of fresh milk at a temperature of from 130° to 140° Fah., the whole being allowed to set into a jelly, which is dried. The dried jelly is then dissolved in another gallon of fresh milk and allowed to set and dry as before, the operation being repeated with fresh milk until the original pound of gelatin has taken up eight gallons of milk or more. Consommé of meat may in like manner be condensed until one pound solid shall represent thirty times its weight of fresh beef. As may be readily guessed, the process may be carried on without any of the expensive plant and troublesome manipulation involved in the usual modes of condensing milk and making Liebig's extract, besides which, in the latter case, the whole of the nitrogenous parts of the meat is preserved intact.

From a hygienic point of view, the lime fruit juice biscuits ought to be admirably suited for use in the navy. Without entering into the question as to whether it is the citric acid, or the phosphatic salts, or the potash contained in the lime juice that is the real anti-scorbutic agent, it is sufficient to say that the 40 per cent of Montserrat lime fruit juice preserved by Dr. Morfit's process, and incorporated with the biscuits, has preserved all its properties without any change for more than a year, and, *a priori*, there is no reason to suppose that it would not keep good for ten or twenty times that period. It may be mentioned, in conclusion, that the different jellies may be dried into hard tablets or flakes at a uniform temperature of from 38° to 40° C., and sent into the market in this convenient form, as well as under the more bulky guise of biscuits. A few cases of lime fruit juice tablets, prepared according to Dr. Morfit's method, would probably have saved the lives of several brave men during the late expedition to the Polar regions.

Speaking from a purely scientific point of view, and judging by the results we have already described, the principle of Dr. Morfit's invention seems to be theoretically a sound one. These results we must regard at present as tentative, and it only remains to the inventor of the process to confer a large benefit on the community by extending its application, thereby notably increasing our not too abundant stock of hygienic and alimentary products.—*Chemical News.*

M. GARRIGOU has lately discovered that the salts dissolved in mineral waters have special properties which render their chemical reactions different from those of the same salts under ordinary conditions.

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The Ring of Fire, and the Volcanic Peaks of the West Coast of the United States.

The Pacific Ocean is not alone remarkable in being the largest body of water on the globe, but also on account of those volcanic phenomena which manifest themselves throughout the whole extent of its boundaries.

Beginning in the southern waters of this great ocean, we find the first noteworthy evidences of volcanic activity in the smoking cones of New Zealand, Tongariro, and White Islands. North we have the Feejee Islands group, with its numerous craters and its thermal springs. Crossing the South Sea at this point, in an oblique direction from the islands of Juan Fernandez, a branch unites with the principal chain passing round the coasts of Australia and New Guinea. Next come in succession the volcanoes of the New Hebrides, the Archipelago of Santa Cruz, and the Solomon Isles, connecting the Feejee group with the region of the Sunda Islands. From Papua to Sumatra, every large island, including Timor, Flores, Bali, Lombok, Sumbawa, and Java; then to the east, Borneo, Celebes, Amboina, Ceram, Gilolo, Mindanao, and Luzon, has one or more volcanic outlets in a state of full activity. This region is the great focus of lava outflow of the globe.

Northward of Luzon the volcanic belt curves, and follows a line parallel with the coast of Asia, and embraces the island of Formosa, the Loo-Choo Archipelago, the islands of Japan, and the Kuriles. To the east of the peninsula of Kamschatka, which possesses no less than fourteen volcanoes in a state of activity, the range of craters describes a graceful curve across the Pacific to the peninsula of Alaska, embracing in its extent thirty-four smoking cones. With a direction first eastward, then south, the volcanic belt extends along the whole western seacoast of North America. In Guatemala and the republics of South America, thirty volcanoes, much more active and terrible than those of Mexico, rise in two chains—one parallel to the coast, and the other crossing the isthmus of Nicaragua obliquely. Some of these mountains of fire have become famous for the appalling disasters which have followed their eruptions.

Still further south the depressions of the isthmus interrupt the volcanic chain, which reappears with the peak of Tolima, 17,716 feet high, in Colombia. South of this and the plateau of Pasto (where there exists a crater) stands the magnificent group of sixteen volcanoes, some extinct, some smoking, over which towers the celebrated Chimborazo. This group occupies an elliptical space, the longer axis of which is only 112 miles long, and includes the well known volcanoes Tunguragua, Carahuiago, Cotopaxi, Antisana, Pichincha, Imbabura, and Sangay. South of Sangay, which is said to be the most destructive volcano on the earth, the chain of the Cordilleras offers no volcanoes for a distance of about 930 miles. The series commences again in Peru, where outlets of eruption, among extinct volcanoes, are here and there seen still in action. The smoking peaks of the mountains Antuco, Osorno, and Villarica, in Chili, terminate the series of the great American volcanoes, but volcanic activity is manifested in less elevated craters, all down the coast to the extremity of Terra del Fuego. The South Shetland Islands, in the Southern Ocean, in a line with North America, are also volcanic in their character. From these, if a circle be swept round through the polar regions, the line will come out along the coasts of Victoria Land, on which are situated the towering peaks of the volcanoes Erebus and Mt. Terror. From this region northward, the line, extending over various small islands of the Antarctic, again touches New Zealand, from whence we started; and thus is completed the great volcanic circle which girdles the Pacific, and which has very aptly been termed the "Ring of Fire."

Although the volcanoes of the greater portion of this circle of 22,000 miles are actually active, those of the United States which are embraced in its limits are at present extinct; and to these, rendered more interesting to us from the light shed on the subject by government explorations, we will now direct our attention. The principal outflows of volcanic rocks, properly so-called, which have taken place within the limits of our country, occurred in the Tertiary period, or that epoch in the world's history which immediately preceded the advent of man on earth. These rocks are mainly confined to the western portion, included in the great elevated region of the Rocky Mountains, and cover a great proportion of the Territories bordering the western coast.

The region embraced in the scene of these volcanic phenomena represents an extent of coast line, north and south, of about 900 miles, and includes the greater part of California and Nevada, all of Oregon and Washington Territories, and a small strip of Idaho.

The western border of the great elevated region included in the Rocky Mountain system is formed by the Sierra Nevada and Cascade ranges, which run in a direction parallel to the coast. The Sierra Nevada rises for a distance of fifty miles, in long gentle slopes, from the plains of California on the west; and on the east presents an abrupt wall overlooking the desert valleys of the interior or Nevada basin. Its highest points are in the region of Mt. Whitney, which reach an elevation of nearly 15,000 feet. From here its crest diminishes slightly to the north; and, where it is crossed by the railroad, its peaks are about 9,000 feet above the sea. In the northern part of California its continuity is broken, and from Lassen's Peak, for nearly 100 miles north, it is broken into ridges and isolated volcanic peaks, which stand regularly interspaced, and rise above the snow line. In Northern Oregon and Washington Territory, the Cascade range occupies a topographical position corresponding with that of the Sierra Nevada.

The Cascade Mountains, however, are of a more recent geological formation, and rise to heights of only 4,000 to 7,000 feet above the sea level. Along the crests of these mountains extends the line of snow-capped volcanic cones. The more prominent of these are Lassen's Peak and Mt. Shasta, in Northern California; Mt. Pitt, the Three Sisters, Mt. Jefferson, and Mt. Hood, in Oregon; and Mts. St. Helen's, Adams, Rainier, and Baker, in Washington Territory.

Lassen's Peak is the most southern of the volcanic peaks, and forms the northern extremity of the Sierra Nevada crest. To the geologist this is especially interesting, and it was through its study that Von Richthofen gathered the facts which led to his classification of the relative ages of volcanic rocks—facts which were embodied in a paper published under the auspices of the California Academy of Sciences in 1868. Here are found remnants of ancient craters made and destroyed ages ago, and abundant traces of long continued activity. The last outflows from these craters were basalt, which has covered an immense extent of country north and east.

Proof of still remaining internal heat is found in its numerous solfataras and hot springs; these are concentrated in the basin of an old crater, called, in the vernacular of the West, "Bummers' Hell." Here are also found the so-called mud volcanoes. Mt. Shasta, one of the grandest and most accessible of our volcanic peaks, stands comparatively isolated. Its summit, carefully measured by the barometer, reaches a height of 14,440 feet above the sea level. On the west of the summit is a beautiful crater, almost perfectly circular in form, nearly a mile in diameter, and with a rim 2,000 feet lower than the main summit. Its interior, about a thousand feet deep, contains a central cone, formed, like the rim, of broken masses of lava. The rim of the crater is a mere knife edge of rock, so narrow that when the parties attached to the government survey visited it and remained over night, they found it necessary to break away the rock with their hammers to make a place wide enough to sleep upon. On the highest point of this rim the lava masses are perforated curiously with holes similar to those made by worms, and these are lined with a green glass, the result of a melting of the rock by lightning, for which this place seems to present great attraction. The main summit is separated into two peaks by a little gorge about 100 feet deep, at the bottom of which is a hot spring. One of the attractions of this peak are the still active glaciers found on its northern slopes. Along the western slope are the remains of hundreds of little volcanic cones. A larger one to the southwest, called Little Shasta, is a miniature reproduction of the larger one, although it is nearly equal in height to Vesuvius. Mt. Pitt, a volcanic peak of beautifully regular outline, is about 60 miles north of Shasta, in Oregon. It is less than 10,000 feet high, yet its summit is crowned with snow most of the year. It likewise shows traces of a crater structure, which is broken down on the northeast side. Throughout the region to the northeast of Shasta, in Eastern Oregon and Northwestern Nevada, immense tracts of country are covered by flows of basaltic rock, popularly known as "Lava Beds." These are cut through in all directions by a network of gorges and ravines, with perpendicular sides, and abound in natural fortresses and caves, and are usually traversed by streams. It was in such hiding places that a handful of Indians, during the late Modoc war, were able to keep at bay all the military force that could be brought against them.

East of Mt. Pitt are numerous lakes, fed largely by springs issuing from volcanic rocks. Most interesting of these is Crater Lake, which fills an ancient crater, eight miles in diameter. The showers of ashes which once issued from this crater can easily be traced, in the peculiar character of the soil, for a distance of about 28 miles east and 10 west of the lake. The volcanic peaks of the Three Sisters and Mt. Jefferson, north of Mt. Pitt, are little known and of small importance, though they form a beautiful feature in the scenery of Oregon.

Mt. Hood, with an outline far more graceful than that of any of the other volcanic peaks, rises out of the very crest of the Cascade Mountains to a height of 11,225 feet, and is considered one of the most beautiful peaks in the world. What was once its crater has long since disappeared, and its summit at present consists of a single block of lava a few feet square only, from which one may look down nearly perpendicularly for thousands of feet. From the fact that clouds frequently collect (even on a cloudless day) around the mouth of what was once a crater, on the north side, frequent reports are made of an eruption on this peak; but an examination has shown to a certainty that no eruption has taken place within the memory of man. Twenty-five miles north of Mt. Hood we find the Columbia river. The region hereabout presents some of the grandest and most picturesque scenery of the United States. Here may be seen, under peculiarly favorable circumstances, volcanic phenomena both of massive eruptions and of crater cones, which attain in this locality an enormous development. This river, which drains an area of 200,000 square miles, has cut its channel transversely through the Cascade Mountains, almost down to the level of the sea, and thus gives us the means of determining the geological age of the period immediately preceding the building up of the basaltic range at this point. This was the Miocene Tertiary—a time when a tropical climate prevailed over our whole continent, and even far up into the Arctic regions.

North of the Columbia river, in Washington Territory, rise two other volcanic peaks. Of these, Mt. Adams, to the east of the summit of the Cascade Mountains, presents a broad, flat summit; and, if it has a crater, it must be of small size. Mt. St. Helen's, to the west, is remarkable for its regular conical shape. It is stated, on pretty good authority, that this cone was in active eruption in the winter of 1841-2. Neither this nor the preceding peak has ever yet been explored or measured, though their altitude has been estimated at 10,000 feet.

Mt. Rainier (the "Techoma," or "Great Snow," of the Indians) is the grandest single peak in the United States, and for grandeur is probably surpassed by very few mountains in the world. Its height is 14,444 feet. Its peak has three summits, of which the central one is a small crater, while the other two are remnants of the walls of a former immense crater, which, if restored, would nearly double the present size of the mountain.

An immense system of glaciers, presenting all the peculiar phenomena of the glaciers of the Alps, flow down from the steep northeastern slopes of this peak, and unite to form the White river, one of the largest streams which flows into Puget Sound.

Mt. Baker, in the extreme northern part of Washington Territory, although but little over 10,000 feet high, is extremely imposing in appearance. It is much nearer the sea than Mt. Rainier, and from its more northerly position has a proportionately greater snow mass. It has been ascended by an Englishman named Coleman, who published an account of his trip in *Harper's Magazine*.

This completes the list of the volcanic peaks of the Cascade Mountains. Going back now to the Sierra Nevada proper, which was elevated above the sea long before the Tertiary period, we find that volcanic activity has been confined rather locally to a few small volcanic vents along its eastern base, and to flows of basaltic rock on its western slopes, covering, in many cases, the gold-bearing gravels of the Tertiary.

Mono Lake, a beautiful sheet of water, 14 miles long, lies at the eastern foot of the Sierras, opposite the Yosemite Valley. The mountains form a precipitous granite wall 8,000 or 9,000 feet high on its western shores, while to the east extend the flat deserts characteristic of the great basin of Nevada. In the midst of the lake is a small island, which contains a crater, and which abounds in hot springs. To the south of the lake extends a line of volcanic craters, forming a low ridge, which are very unimportant as compared with the lofty peaks of the Sierras, since their highest point rises only 2,700 feet above the neighboring valleys. They are extremely remarkable for the black glass-like rock of which they are formed, and which is known to mineralogists as obsidian. The craters are usually surrounded by a "cinder cone," or circular ridge of loose scoriæ and volcanic ashes, and within this are piled up irregular masses of gray glass and white frothy pumice, the latter so light that it floats on water.

Mr. S. F. Emmons (of Clarence King's Geological Survey), to whom we are indebted for the facts in regard to the volcanoes of the Pacific coast of the United States, remarks that this whole region "must have been the scene of terrific exhibitions of volcanic phenomena, in comparison with which the catastrophes of modern times would sink into insignificance. In the upper basin of the Columbia and Snake rivers, tens of thousands of square miles were covered with continuous sheets of volcanic rock, often many hundreds of feet in thickness. As the massive eruptions of volcanic material gradually ceased, and the gaping fissures in the earth's surface were covered over, we may imagine along the western coast of that time a line of volcanic vents, like beacon fires, lighting up the rocky headlands, and from which issued continuous clouds of steam and sulphurous gases, accompanied by frequent showers of rock and ash, and outflows of hot lava, which gradually built up around the orifices immense mountain masses. At what time these eruptions ceased we have now no means of definitely determining. In the cold, white peaks of to-day, however, scored and carved by glaciers, so that in many cases only traces of their former structure are left, the casual observer would scarcely suspect that he was looking on these ancient fiery mountains. And yet even now there slumbers within their mass a spark of the ancient fire, which may some day break forth into a conflagration."

To Imitate Ground Glass.

Put a piece of putty in muslin, twist the fabric tight, and tie it into the shape of a pad; well clean the glass first, and then apply the putty by dabbing it equally all over the glass. The putty will exude sufficiently through the muslin to render it opaque. Let it dry hard and then varnish. If a pattern is required, cut it out on paper as a stencil plate, and fix it on the glass before applying the putty, then proceed as above; remove the stencil when finished. If there should be any objection to the existence of the clear spaces, cover with slightly opaque varnish.

RAILROAD BIRDS.—A water wagtail has built her nest for two years beneath the roof of a third class carriage on the London and Southwestern Railway. The carriage is in constant use, but the bird does not appear to be in the least disturbed by the noise or jolting of travel, but complacently accompanies her brood. The cock bird is philosophic, and when his spouse departs on a trip quietly awaits her return.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Church Pipe Organs, new and second-hand, ready for delivery. Send for particulars. Henry Erben & Co., Organ Builders, East 23d St. near 2d Ave., New York.

For best Cylinder Oil, R. J. Chard, New York.

Emery in Bbls. and Cans, all numbers, at lowest rates. Greene, Tweed & Co., 18 Park Place, N. Y.

Kreider, Campbell & Co., 1030 Germantown Ave., Phila., Pa., contractors for mills for all kinds of grinding.

The only Engine in the market attached to boiler having cold bearings. F.F.& A.B.Landis, Lancaster, Pa.

To Steam Users, Engineers, Boiler Makers and Inspectors. Send for book with valuable information. The use of coal with economy; horse power of engines and boilers; safe pressure; grate and heating surface; coal and water required per horse power. Price 25 cents. Lovegrove & Co., Philadelphia, Pa.

Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D.Gilbert & Son, 212 Chester St., Phila., Pa.

The Chemical Laboratory of Rutgers College will be open from July 5 to September 5, for special courses in analytical chemistry, mineralogy, and experimental chemical investigation. For terms, etc., address Prof. P. T. Austen, Ph.D., F.C.S., Lock Box 2, New Brunswick, N. J.

For Telegraph Instruments, Electric Bells, all parts of the Telephone, etc., send to Milton F.Jones, Natick, Mass.

If Mr. Z. K. S., of Query No. 12, page 410, date June 29, will send his name and address to Wm. S. Dean, Box 600, Hornellsville, N. Y., he can learn something very much to his advantage.

Publishers of Scientific, Mechanical, or Trade Journals in any portion of the world, will serve their interests by sending sample copies with advertising rates to Chas. K. Hammitt's Advertising Agency, 206 Broadway, New York., U. S. A.

For first rate Hand, Foot, or Steam Band Saws, price $35.00, address G. W. Baker, Wilmington, Del.

Blake's Belt Studs. The best fastening for Leather and Rubber Belting. Greene, Tweed & Co.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

Pulverizing Mills for all hard substance and grinding purposes. Walker Bros. & Co., 23d and Wood St., Phila.

Best Steam Pipe & Boiler Covering. P.Carey, Dayton, O.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Painters' Metal Graining Plates. J.J.Callow, Clevel'd, O.

Foot Lathes, Fret Saws, 6c., 90 pp. E.Brown, Lowell, Ms.

Water Wheels, increased power. O.J.Bollinger, York, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For Heavy Punches, Shears, Boiler Shop Rolls, Radial Drills, etc., send to Hilles & Jones, Wilmington, Del.

2d hand Planers, 7′ x 30″, $300; 6′ x 24″, $225; 5′ x 24″, $200; sc. cutt. b'k g'd Lathe, 9′ x 28″, $200; A.C.Stebbins, Worcester, Mass.

Valuable Invention to users of Steam Boilers. See advt., page 318, May 18, '78. Address U. S. Automatic Stoker Co., No. 2 Chestnut St., Philadelphia, Pa.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Cheap but Good. The "Roberts Engine," see cut in this paper, June 1st, 1878. Also horizontal and vertical engines and boilers. E. E. Roberts, 107 Liberty St., N. Y.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

Bound Volumes of the Scientific American.—I have on hand bound volumes of the Scientific American, which I will sell (singly or together) at $1 each, to be sent by express. See advertisement on page 30. John Edwards, P. O. Box 786, N. Y.

Friction Clutches for heavy work. Can be run at high speeds, and start gradual. Safety Elevators and Hoisting Machinery a specialty. D. Frisbie & Co., New Haven, Ct.

1,000 2d hand machines for sale Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Best Wood Cutting Machinery, of the latest improved kinds, eminently superior, manufactured by Bentel, Margedant & Co., Hamilton, Ohio, at lowest prices.

We make steel castings from ¼ to 10,000 lbs. weight 3 times as strong as cast iron. 12,000 Crank Shafts of this steel now running and proved superior to wrought iron. Circulars and price list free. Address Chester Steel Castings Co., Evelina St., Philadelphia, Pa.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St. Wm. Sellers & Co.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N.J., gave the best results at Centennial tets.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., U.S.A.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

NEW BOOKS AND PUBLICATIONS.

PHYSICAL TECHNICS. Translated from the German of Dr. J. Frick by John D Easter, Ph.D. J. B. Lippincott & Co., Publishers, Philadelphia, Pa.

This is a second edition of a work which for many years has been recognized as a valuable guide for the student of physics. Its aim is to instruct how to perform the experimental part of the science with the simplest materials and at the least cost, and the information given is of the directly practical order, which is requisite in a handbook designed for ready and constant reference. The chapters of the opening part relate to the arrangement of the laboratory and the necessary manipulations of glass, metals, etc., in the preparation of apparatus. Then follow chapters describing experiments on the equilibrium of forces, on motion or acoustics, on light, on magnetism, on electricity, and on heat, illustrated by about eight hundred engravings. The present edition has been revised and some new matter added. The work is an excellent one, and to all engaged in teaching the science will be of especial utility.

THE SPEAKING TELEPHONE, TALKING PHONOGRAPH, AND OTHER NOVELTIES. By George B. Prescott. Published by D. Appleton & Co., 549 and 551 Broadway, New York.

This is the first extended publication in book form which has appeared giving a complete and connected account of the recent remarkable inventions above noted, together with the history of their inception. For this reason, and because also the book is prepared excellently well by a very eminent electrician, we can commend it to our readers, and especially to the large number who constantly send us inquiries as to the mode of construction of the telephone. Mr. Prescott opens with a general review of the various kinds of telephones, then gives a complete account of Bell's researches, telephonic investigations abroad, the production of galvanic music, and the labors of Gray, Edison, Dolbear, Channing, Blake, and others. There is a capital chapter on the phonograph, a concise exposition of the quadruplex system of telegraphy, and two valuable discussions on electric call bells and the latest improvements in the electric light. The work is timely and interesting, and deserves to be widely read.

A MANUAL OF THE CARBON PROCESS. Translated from the German (6th) edition of Dr. Paul E. Liesegang by R. B. Marston. The Scovill Manufacturing Co., New York, Publishers.

This is a complete practical handbook, giving all the various processes of carbon printing or permanent photography. The different subjects are very elaborately treated, the descriptions are clear and are supplemented by good illustrations. Directions are given for preparing the various chemicals and papers, how to make, transfer, and color prints, how to multiply and enlarge negatives, and there is an excellent chapter on the failures which a tyro in the art is likely to meet with, with instructions how best to remedy or avoid them.

Notes & Queries

(1) L. A. H. asks for a good work on perspective drawing. I have a slight knowledge of isometrical perspective, but wish to become thoroughly competent to draw plans of machinery, etc., in perspective. A. See lessons on pp. 229 and 1019, SCIENTIFIC AMERICAN SUPPLEMENT. Consult Churche's "Descriptive Geometry" and Warren's "Higher Linear Perspective."

(2) A. H. C. writes: Having a controversy with a gentleman about the moon's having a great effect on the weather, and he saying that the U. S. Signal Service took the moon for one basis, we refer it to you to settle it. A. We take no observations of the moon at this office when we take our observations of the weather. The distance of the moon from the meridian influences the height of the barometer, but so slightly that the moon's position is not taken as a factor in prognosticating the weather.—J. T. C., U. S. Signal Office, New York city.

(3) C. H. W. asks: Is there any work published which treats of the construction and working of the microscope? I want to make an instrument magnifying from two to three hundred and fifty diameters. A. Consult "The Microscope," Hogg; "The Microscope and its Revelations," Carpenter; "How to Work with the Microscope," Beale; "Text Book of the Microscope," Griffith and Henfrey.

(4) H. W. K. writes: While listening in a telephone there is a continual crackling noise, which is greatly increased in a foggy or rainy day. Is not this caused by currents of electricity in the ground (the telephone has a return circuit through the ground), and why are they more intense in dampweather than in dry? A. The crackling may be produced by earth currents. It may also proceed from currents induced in the telephone line by parallel telegraph wires.

How many cells Callaud battery will it take to melt a No. 40 copper wire? A. About 40.

(5) H. R. asks: 1. Can you inform me how strong horseshoe or other magnets can be made? A. *a*. By placing on each end of a hardened steel bar a soft iron cylinder, and surrounding the whole with a helix which is connected with the poles of a powerful battery. *b*. By placing the hardened steel bar against the face of a strong electro-magnet. 2. Is there such a thing as an electric engine? A. Yes. See any work on physics. 3. What kind of lime is used for making the lime-light? A. A good clear piece of common unslaked lime will answer. It is sometimes prepared by calcining marble.

(6) E. D. S. asks: 1. How is the signal bell on the telephone worked without a battery? A. With a small magneto-electric machine. 2. How can I make something of the kind, or to answer the purpose? A. An alarm cannot be easily made. See answer to L. O. B. on this page. 3. What is the size of the inclosed wire, and will it answer to construct a telephone line a half mile long? A. The wire is No. 16. It will answer, but larger would be better.

(7) W. J. P. writes: I want to drive a machine shop 1,200 feet from a boiler and engine. Which is the best and cheapest way to transmit my power? A. Use an endless wire cable.

(8) J. B. writes: I have a telephone line 1 mile long, with Bell's telephones at each end. Now when I speak at one end how does the sound reproduce itself at the other end? A. When a sound is made in the mouthpiece of the transmitting instrument, the diaphragm of the instrument vibrates in unison with the sound, and by approaching and receding from the magnet disturbs its normal magnetic condition and thus generates electric currents in the surrounding helix. These currents are transmitted to the helix of the receiving instrument, where they change the magnetic condition of the bar contained by the helix so that the diaphragm of the receiving instrument vibrates in exactly the same manner as that of the transmitting instrument.

(9) L. O. B. asks for a description of the machine for generating electricity, without the use of a battery, such as is used in connection with telephones to strike bells and call attention. A. We intend to publish in the SCIENTIFIC AMERICAN SUPPLEMENT, at an early date, a full description of a small magneto-electric machine that will answer your purpose.

(10) S. L. asks for a recipe for turpentine varnish, and for "Worcestershire sauce." A. Mastic in tears, 12 ozs.; pounded glass, 5 ozs.; camphor, ½ oz.; oil of turpentine, 1 quart; digest with agitation until dissolved; then add Venice turpentine 1½ ozs., previously liquefied by a gentle heat. Mix well and the next day decant. The recipe for Lea & Perrin's Worcestershire sauce is not published.

(11) A subscriber inquires how peach brandy is made. A. Bruise the peaches, steep them in twice their weight of brandy, and express the liquor; or, bitter almonds (bruised), 2 ozs.; proof spirit, 10 gallons; water, 3 gallons; sugar, 6 lbs.; orange flower water, ½ pint; macerate together for two weeks.

Is there any handy book published showing, by its aid, how to make cheese? A. We know of no work devoted entirely to cheese making; Willard's "Practical Dairy Husbandry" may be of some service. See also pp. 178–182 Cooley's "Cyclopedia of Practical Receipts."

(12) A. A. R. asks: How can I cut a scale of inches and fractions of an inch on a glass tube which I design using for a rain and snow gauge? A. You may do it with a fine file wet with turpentine, or with a thin copper disk revolved in a lathe and wet with water charged with No. 1 emery.

(13) B. A. asks how pepsin is prepared. A. Pepsin is a nitrogenous substance existing in the gastric juice, and as a viscid matter in the peptic gland and on the walls of the stomachs of animals. The mucous membrane of the stomach (of the hog, sheep, or calf, killed fasting) is scraped, and macerated in cold water for twelve hours; the pepsin in the strained liquid is then precipitated by acetate of lead, the deposit washed once or twice by decantation, sulphureted hydrogen passed through the mixture of the deposit with a little water to remove the whole of the lead, and the filtered liquid evaporated to dryness at a temperature not exceeding 105° Fah. As met with in pharmacy the strength of pepsin varies greatly. It is often prepared by simply mixing with starch the thick liquid obtained on macerating the scraped stomach with water, and evaporating to dryness. The composition of pepsin is not positively known.

(14) P. L. O. asks: How do you use emery powder to clean rusted tools? A. Apply it with oil and a piece of leather, cork, or thick cloth.

(15) F. M. C. asks: Is there any mixture that will cause iron to break by eating it away? A. Nitric, hydrochloric, or sulphuric acids, or a moistened mixture of 14 parts acid potassium sulphate, 4 parts ammonium chloride, and 7 parts potassium nitrate, powdered and intimately mixed.

(16) S. W. asks: What is meant by foot pounds when we are speaking of steam power? A. When we say that 100 foot pounds of work are performed, we mean that an effort has been exerted equivalent to raising 100 pounds 1 foot high, 1 pound 100 feet high, 2 pounds 50 feet high, or any number of pounds raised to such a height that the product of the power and weight is 100.

(17) O. L. asks: How can I make chlorine gas? A. Pour strong hydrochloric acid over black oxide of manganese in coarse powder, and apply a gentle heat; chlorine is given off abundantly. Or pour over a mixture of equal measures of black oxide of manganese and common salt a small quantity of sulphuric acid diluted with an equal volume of water.

What acids will affect platinum foil? A. A warm mixture of 3 parts strong hydrochloric and 1 part nitric acids.

(18) F. M. H. asks: Is there any process of photography that is simple, easily understood (without much practice), and at the same time cheap, in a compact form, and practical? A. Some one of the dry plate processes may possibly come within the prescribed limits. See articles on pp. 304 and 231, SCIENTIFIC AMERICAN, vol. 36, and 161, 765, 809, 1004, 1017, SCIENTIFIC AMERICAN SUPPLEMENT.

We have had great difficulty in making paint stay any length of time on our boats where they come in contact with the water of the canal which is an outlet for Chicago river impurities (sewerage, etc.). What is the cause, and how can we remedy it? A. From such data we cannot judge; test the water with a little litmus; if the reaction is notably alkaline, you have the secret. It may also be partially due to the abrasion of much suspended mineral matter. In the former case you may apply some protective varnish, such as that described on pp. 149 and 159, "Science Record," 1874.

(19) J. G. H. asks: 1. What can I put into burnishing ink, such as is used in shoe manufactories, to produce a black gloss? A. Shellac, 4 ozs.; borax, 1 oz.; water, q. s.: boil to the consistence of sirup and add a few drops of strong ammonia water. A small amount of soap is sometimes also introduced; add a sufficient quantity of this to the ink used to obtain the desired result. Instead of the above, soap is often used alone or with a trace of glycerin, ammonia, or gum arabic. 2. What causes the ink to scale, after being burnished, and how can I prevent it? A. Probably the use of a poor ink.

(20) A. W. G. asks how to make soiled wringer rolls look like new. A. Try a little dilute hydrochloric acid or strong aqueous solution of zinc chloride.

How is rubber melted to make rubber hand stamps? A. See p 1326, SCIENTIFIC AMERICAN SUPPLEMENT, No. 83.

(21) C. W. M. asks: 1. Will you give me a recipe to prevent fishing lines from rotting? A. Digest them for 12 hours in a solution of 1 lb. of white soap in 10 gallons of water; then for six hours in solution of alum, or, better, acetate of alumina in 20 parts of hot water. 2. Is there any scientific foundation for the popular superstition that fish bite better when the moon is full? A. No.

(22) E. D. A. asks if a railroad train is not more liable to run off the track in making a short curve at a high rate of speed than slow. Also scientific reasons therefor. A. Yes; because the force tending to throw it off varies as the square of the speed.

(23) L. C. B. asks: What material is best to use to harden plaster of Paris casts after the castings are made, so as to imitate white or gray marble? A. You may try strong solution of silicate of soda, alone or with concentrated aqueous solution of alum or magnesium sulphate; then wash in lime water or lead acetate.

(24) J. H. McF. asks: What kind of covering or coating will render the plastered walls of a bleach house impervious to the fumes of burning sulphur and not be affected thereby? A. You may apply to the dry walls a strong benzole solution of paraffin or wax. The former is preferable.

(25) J. B. asks for a recipe to make mushroom catsup. A. Sprinkle the trimmed tops with salt, stir them occasionally for 2 or 3 days, then lightly press out the juice; add to each gallon of this ½ oz. each of bruised mustard seed and cloves, and 1 oz. each bruised allspice, black pepper, and gently simmer for an hour in a porcelain lined iron vessel; cool, strain, and bottle.

(26) C. M. F. writes: I would like to learn the machinist's trade so as to be a good engineer afterward. I am 19 years old. Where would be a good place to go to learn it? A. You would probably get the greatest experience in the shortest time in a repair shop.

(27) M. says: We use a copper boiler for dyeing wool and homespun black with bichromate of potash and logwood, and same kind of goods brown with camwood, sulphuric acid, and copperas. 1. Would an iron boiler do just as well? A. No. 2. At present we use two open boilers of about 120 gallons capacity each, heated from beneath. Would steam from a shell boiler, 6 feet long and 30 inches diameter, keep the water in the above mentioned boilers, or vats of like capacity, up to the boiling point while used for dyeing purposes? A. As we understand you, not unless the steam used is under 8 or 10 lbs. pressure.

(28) W. H. P. asks for a strong waterproof and flexible cement for joining sheets of manila paper to form a board. A. Good pitch and gutta percha (about equal parts) are fused together, and to 9 parts of this are added 3 parts of boiled oil and one fifth part of litharge; continue the heat with stirring until thorough union of the ingredients is effected. This is applied hot or cooled somewhat, and thinned with a small quantity of benzole or turpentine oil.

(29) H. B. F. asks for a recipe for mixture of a whitewash for wooden or brick outdoor purposes, such as used by the government. A. Slake half a bushel good lime in boiling water in a covered vessel, and strain it through a fine sieve; add a peck of salt dissolved in a small quantity of hot water, 3 lbs. of rice boiled with water to a thin paste, 1 lb. of Spanish whiting, 1 lb. glue softened by soaking in water and then dissolved over a water bath, and 5 gallons of hot water. Agitate, cover from dust, and allow to stand several days. Apply hot. Slaked lime or hydraulic cement mixed with skimmed milk makes a cheap and durable paint for outdoor work.

(30) D. H. asks: What kind of varnish or gum would be suitable to make waterproof and put together sheets of paper to make a paper canoe, and what description of paper would be most suitable? A. Sheets of stout manila passed through a hot bath of aqueous solution of zinc chloride (at 75° B.) pressed strongly together and then soaked in dilute aqueous soda solution containing a small amount of glycerin cohere to form a strong, stiff, waterproof board admirably adapted to the construction of small boats. Single sheets of paper passed quickly through the zinc chloride bath, pressed and washed and dried, are waterproof, and may be otherwise joined to form waterproof boards by any suitable cement. See answer to W. H. P., this page; also p. 10, vol. 38, SCIENTIFIC AMERICAN.

(31) T. R. W. asks (1) for a good recipe for an indelible ink for marking on linen, either with or without previous preparation. A. (1) Add caustic alkali to a saturated aqueous solution of cuprous chloride until no further precipitate forms; allow the precipitate to settle, draw off the supernatant liquid with a siphon, and dissolve the hydrated copper oxide in the smallest possible quantity of ammonia. It may be mixed with about six per cent of gum dextrin for use. Before washing pass a hot iron over the writing. (2) Asphaltum, 1 part; oil of turpentine, 4 parts; dissolve and temper with printer's ink. Best used with a stamp. See other recipes on this page. 2. Also please inform me what solution will be durable and best suited for marking on zinc tags, exposed to the weather. A. The latter (2) may be used on zinc tags.

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(32) J. H. K. and others.—Mix two or three drachms of white arsenic (arsenious acid) with an equal quantity of sodium carbonate and dissolve the mixture in a pint of boiling water, to which add also an ounce or more of honey. This may be projected, in limited quantity, by means of a small syringe, well into all open cracks in the walls and floors of rooms infested with the insects. The latter will soon discover the honey, and die. The only precaution necessary in the use of this mixture is that it should not be deposited or kept within the reach of children or domestic animals, or with medicines, etc., for which it is liable under any circumstances to be mistaken. It is better to make the small quantity required and use it at once.

(33) D. W. B. asks: Does the injector send a steady stream of water into the boiler, or is it in the form of spray? A. A steady stream.

Are most of the transatlantic steamships made in America or Europe? A. In Europe.

What is the proportion between the length and width of a steamboat beam? A. It varies greatly, as much as from 4 to 12 or even more.

(34) D. P. writes: We have tried concentrated lye as a preventive to the formation of scale in our boiler, and find it effective. Is there any danger of injury to the boiler, or any other objection to its continued use? A. If you blow off and clean the boiler regularly every two or three weeks, we see no objection.

(35) H. B. C. asks: 1. Does a permanent magnet lose or gain by being in constant use? A. A gradual diminution of power occurs when the keeper or armature is not in contact with the poles. 2. Which is the stronger, a compound or solid magnet of equal weight? A. A compound. See p. 227, "Science Record" for 1874. 3. Will an electro-magnetic machine produce magnetism of much power in an electro-magnet? A. Yes.

(36) H. K. A. asks: 1. How do scientists ascertain the average rainfall? A. Take a quart bottle of uniform diameter and graduate its liquid contents by a scale of tenths of an inch accurately engraved on the side; fit into the neck of the bottle a 40° funnel, the diameter (in inches) at the rim or widest part of which has been accurately ascertained; then diameter square × ·7854 = area in inches of the base of the inverted cone. Suspend the rain gauge in an upright and exposed position. Then, number of inches of rain collected in the bottle ÷ time of exposure = average rainfall in inches. The gauge should of course be out of the reach of spattering water from surrounding objects, and in order to avoid great error through the spattering of the water from the funnel, the angle of the sides of the latter should not be greater than 40°. The neck of the funnel should be narrow and due allowance must be made for evaporation. Readings should be taken if possible before as well as after a rain all. The indications of this simple instrument are sufficiently accurate for all ordinary purposes. 2. Would a tin pail set out during a shower where the water could not blow from any other object into it, and set high enough from the ground so that water could not spatter into it, register the rainfall for that particular section (the pail being the same size from bottom to top) by measuring the water in the pail? In other words, would the depth of water in the pail be the rainfall? A. Yes.

(37) W. C. R. asks for a recipe for a glue to fasten paper on glass; it must be colorless. A. (1.) Soak isinglass in water until it is soft, then dissolve it in the smallest possible quantity of proof spirit by the aid of gentle heat; in 2 ozs. of this mixture dissolve 10 grains of gum ammoniacum, and while still liquid add half a drachm of mastic dissolved in 3 drachms of rectified spirit. It is liquefied for use by standing the bottle containing it in hot water for a moment. (2.) Good starch paste is often used.

(38) G. F. S. asks: 1. Can you silver plate on lead or pewter? A. Yes, though with difficulty. It requires an intense current and a strong solution to throw on the first coating. 2. Give solution for copper plating. A. Dissolve sulphate of copper in 4 parts of not rain water; allow to cool before using.

(39) F. B. M. asks: 1. What is the best way of making a good paste blacking? Please give formula. A. See recipe on page 27. 2. How would you make the best of liquid blacking? A. Soft water, 1 gallon; extract of logwood, 6 ozs.; dissolve: soft water, 1 gallon; borax, 6 ozs.; shellac, 1½ oz.; boil until dissolved: potassium bichromate, ¾ oz.; water, ½ pint; dissolve, and add all together while warm.

(40) A. F. asks: How can I keep a working board clean from oil and spots? A. Cover the wood with a quantity of hot pipe clay over night; or apply a little benzine and use the clay cold.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. W. C.—Slate containing pyrites.—J. A. P.—The deposit consists mainly of clay, silica, lime sulphate, iron oxide, and a little organic matter. It may be used as a cheap pigment, either before or after calcination. It does not contain phosphates.—J. J.—No. 1 is red jasper—an impure quartz, the coloring matter of which is iron sesquioxide. No. 2 is dolerite containing iron pyrite, of no value.—M. M.—They are clay stones, formed by eddies of water.—E. D. M.—They are nodular pyrites—iron sulphide.—M. F.—Specimens of banded agate, rose and amethystine quartz.—Will Canadian correspondent who sent sample of talc please send his address?—W. T. J.—Nodular pyrites—iron sulphide.—O. A. A.—The chalk is foramniferous; use a $\frac{1}{10}$ objective.—D. L.—The sample is a clay—silicate of alumina—containing much salt, a little iron oxide, lime and magnesia sulphate, and silica. It is not of much value.

English Patents Issued to Americans.

From May 10 to May 30, 1878, inclusive.

Advertising apparatus.—E. Bostock *et al.*, N. Y. city.
Artificial leather.—E. E. Floyd, Boston, Mass.
Boat lowering apparatus.—M. Bourke *et al.*, Youngstown, O.
Boiler pressure regulator.—H. G. Ashton, Boston, Mass.
Book holder.—A. Mason, N. Y. city.
Bottle stopper.—C. O. Hammer, Pittsburg, Pa.
Ditching machine.—T. Fitz-Randolph, Morristown, N.J.
Drain trap.—H. Palmer, Rochester, N. Y.
Electric battery.—C. Brush, Cleveland, O.
Electro-motor.—D. Ward *et al.*, Berkshire, N. Y.
Gas manufacture.—H. W. Adams, Philadelphia, Pa.
Gas manufacture.—W. Harkness, N. Y. city.
Governor.—C. C. Jenkins, Philadelphia, Pa.
Grain drier.—E. H. Gratiot, Platteville, Wis.
Grinding machine.—G. G. Lobdell, Wilmington, Del.
Iron manufacture.—D. Thomas, St. Louis, Mo.
Ladder and hose elevator.—G. Juengst, N. Y. city.
Lead projectiles.—L. Crooke, N. Y. city.
Life boat —M. Bourke *et al.*, Youngstown, O.
Life saving apparatus.—E. S. Hunt, Weymouth, Mass.
Lubricator.—C. Harris, N. Y. city.
Machine gun.—D. W. C. Farrington, Lowell, Mass.
Milling machinery.—Milwaukee Middlings Millstone Co., Milwaukee, Wis.
Nail machine.—H. B. Sheridan, Cleveland, O.
Non-conducting covering.—B.F.Smith, New Orleans, La.
Printer's quoins.—H. A. Hempel *et al.*, Buffalo, N. Y.
Propeller.—J. Baird, N. Y. city.
Railway truck.—G. Vincent, San Francisco, Cal.
Refining metals.—N. S. Keith, Brooklyn, N. Y.
Rolling mills.—W. R. Jenkins, Jr., Bellefonte, Pa.
Rubber cutter.—C. Ford *et al.*, N. Y. city.
Screw cutting machine.—H. E. Russell, New Britain, Ct.
Steam boiler.—S. J. Gold, Cornwall, Conn.
Telephone.—E. Gray, Chicago, Ill.
Tripod for instruments.—D. Hoffman, Philadelphia, Pa.
Water meter.—C. C. Barton *et al.*, Rochester, N. Y.
Wool scouring machine.—C.K.Bradford, Lynnfield, Mass.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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April 30, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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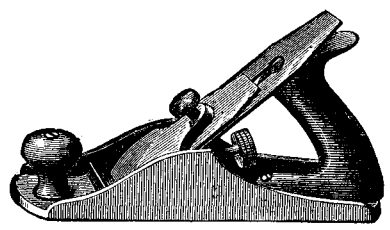

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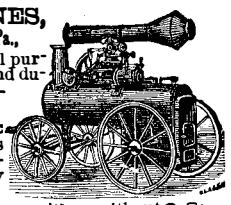

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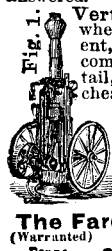

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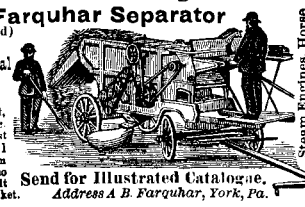

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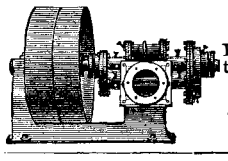

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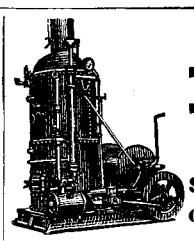

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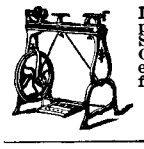

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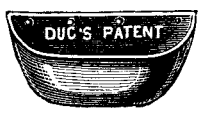

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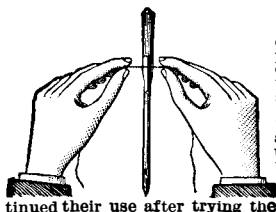

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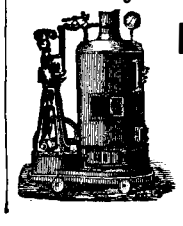

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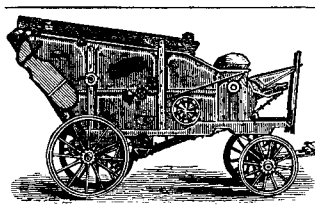

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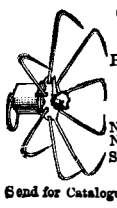

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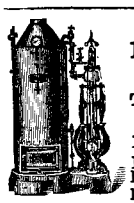

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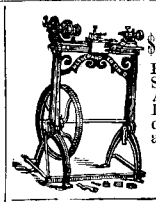

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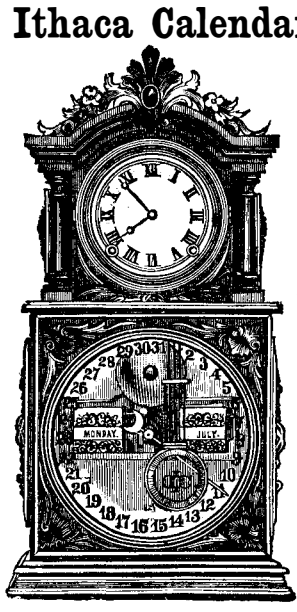

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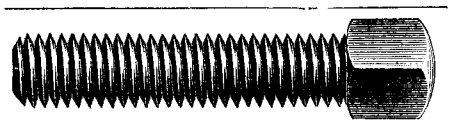

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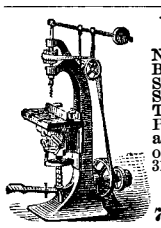

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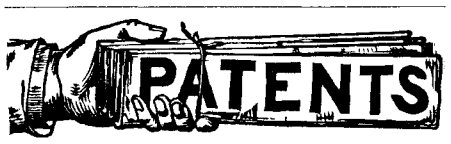

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